SCIENTIFIC AMERICAN

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AGRICULTURAL INVENTIONS.

Mr. Sterling A. Millard, of Clayville, N. Y., has invented a scythe blade that contains much less weight of metal and possesses equal or greater strength than the ordinary scythe blades. It is made in the usual manner from what is termed by scythe makers a "scythe rod," and is wrought and shaped in such form that a proper thickness is left to serve as the back of the blade. A longitudinal auxiliary rib or supplementary back is formed on the blade, which stiffens the scythe without requiring the same weight of metal as those of the usual construction.

Mr. George C. Winslow, of Kalamazoo, Mich., has patented an improvement in spring harrow teeth, which consists generally in hinging the harrow tooth in the forward end of a rectangular frame bolted to the harrow bar, and combining therewith a spring, which at its back end is clamped to the harrow bar by the same bolts which secure the rectangular frame, and which spring then curves upward and forward, and then down through the slot or opening of the rectangular frame, and is jointed at its extremity, near the bottom of the harrow tooth, so that its tension serves to throw the harrow tooth forward, but allows it to yield to obstruction.

A Rare Specimen Lost.

Captain Ingalls, of the schooner Chalcedony, has let slip an opportunity to make a small fortune and at the same time settle the long vexed question as to the reality of the elusive and possibly mythical sea serpent. His story, as told in the *Argus*, of Portland, Maine, June 8, runs as follows:

"Last Saturday, about one o'clock in the afternoon, we were slowly sailing past Monhegan, there being very little wind, about twenty miles southwest of the island, when we caught sight of what looked like a large schooner floating bottom up. As the object lay almost dead ahead, we made directly for it, but before we got very close a Cape Ann schooner lay to and sent a boat's crew to inspect what now plainly appeared to be a monstrous carcass of some species or other. We finally hove to, about a ship's length off, and took a leisurely survey of the thing. It was dead, and floated on the water, with its belly, of a dirty brown color, up. It head was at least twenty feet long, and about ten feet through at the thickest point. About midway of the body, which was, I should guess, about forty feet long, were two fins, of a clear white, each about twelve feet in length. The body seemed to taper from the back of the head down to the size of a small log, distinct from the whale tribe, as the end had nothing that looked like a fluke. The shape of the creature's head was more like a tierce than anything I can liken it to. I have seen almost all kinds of shapes that can be found in these waters, but never saw the like of this before.

Two years ago, off Seguin, I saw shooting through the water a thing which, I think, resembled this creature considerably, but I didn't get close enough to it to say for certain. The men from the Cape Ann schooner got on this dead creature, and one of the boys cut a double shuffle on its belly, which for all the world looked like the bottom of a schooner covered with barnacles and seaweed by the weather. We should have towed the thing to Portland had there been any wind, but as there wasn't, we steered away and left it. What sort of a sea monster this was I can't say for sure, but in my opinion it was the original 'sea serpent,' which has been seen once in a while for years past, and which, when alive, was too swift a swimmer for any sailing vessel to get alongside of."

The report of the captain of the "Cape Ann schooner" will be in order now.

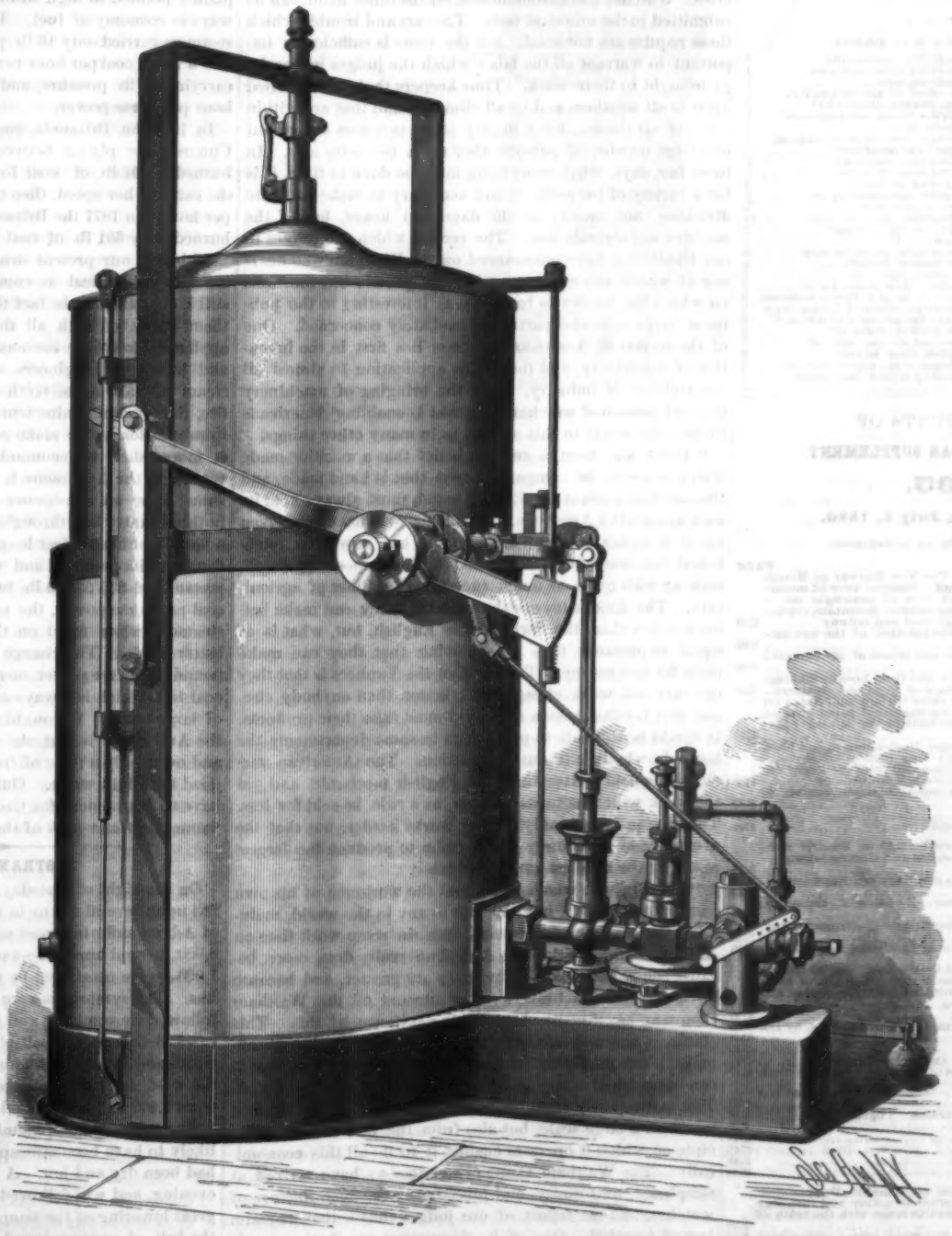
SIMPLE AND CHEAP PROCESS OF GAS MAKING.

When a current of air is passed over the surface of gasoline it becomes carbureted or charged with its vapors to saturation. Air thus charged is somewhat heavier than pure air, and when passed through an Argand or bat's wing burner, it burns with a brilliant white flame. Nothing would seem easier than to make a machine that would force a current of air through, over, or on some material saturated with gasoline, and this apparently simple process has led many into attempts to make a successful gas machine. Many fortunes have been spent by the unscientific in the chase after this, to them, *ignis fatuus*. The stumbling block which has wrecked so many enterprises in this line has been the cold produced by the evaporation of the gasoline. One pound of gasoline, in passing from a liquid to a vapor, requires about as much heat as would be required to melt two pounds of cast iron. It is therefore obvious that where no heat is supplied, the gasoline, air, and machine must soon become very cold when any considerable quantity of gas is being made. The heat must come from somewhere, and as none is supplied, it is taken from the apparatus, air, and gasoline, making them very cold. A beautiful and simple experiment to illustrate this refrigeration can be made as follows: Place a gill of water in a common washbasin, then pour over it one pint of light gasoline; shake the basin, and blow the liquids vigorously, when very soon the basin will become intensely cold—the water will freeze, and may be taken out in the form of a snowball. If the water and basin are hot, and the experiment performed in a hot room or in the sun, it is much more striking.*

This refrigeration operates upon the gas as follows: Air will take up and hold in suspension any volatile liquid in proportion to the square of its temperature, so that when the temperature of the gasoline and air have fallen off one half, the quantity of gasoline in the air has fallen off three quarters, and the light is destroyed. The quality of the gas in such machines varies from a rich smoky flame to a pale blue and blowing flame in a short time. Every change of quality in the liquid, temperature of the apparatus, or number of burners used causes a vexatious change in the quality of the gas. If heat is applied at the right time and in the right quantity it is not so bad, but too much heat, or neglecting to regulate it properly, converts the machine into a still, the condenser of which is the pipes of the building lighted, when danger is added to vexation. About ten years ago a machine was illustrated in these columns that obviated all these troubles; it was the invention of the well known mechanical engineer, Hiram S. Maxim, of this city. His machine was on an entirely new principle, and has since gone into general use. It was intricate and somewhat expensive, but it performed its work well. Messrs. A. T. Stewart & Co. use them largely in their mills and hotels. Mr. Maxim made one of six thousand burner capacity for the Grand Union Hotel, Saratoga Springs, it being the largest gas machine ever built. It has supplied gas of an unvarying quality for six years, and is as good as new to-day.

To reduce the cost as far as possible, Mr. Maxim has designed a new machine on another principle, which we herewith illustrate. Fig. 1 shows the machine in perspective, and Fig. 2 is a sectional view. The vertical cylinder is a common gas holder of sheet brass. It is 36 inches in diameter for a thousand burner machine. The operative parts of the machine are best shown in the sectional view, which represents the portion of the machine called the injector. A is a steam chamber supplied with four or more pounds of steam through the pipe, K. B is the gasoline supply pipe, and C the air supply. D is an index valve. The operation is as follows: Steam being in the chamber, A, the descent of the holder opens the valve, M, and allows the steam to

[*Continued on page 4.*]



MAXIM'S NEW GAS MACHINE.

* This experiment should not be tried in the vicinity of a gaslight or fire.

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NEW YORK, SATURDAY, JULY 3, 1880.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions	1	Inventions, mechanical	7
Aspirator and compressor*	11	Inventions, miscellaneous	4
Astronomical notes	11	Inventions, new	11
Baby elephant takes a bath	7	Iron, effect of age on quality	3
Bath, shower, portable, new*	6	Lamp, electric, improved*	5
Boiler explosions, prevention of*	4	Leadville mines and railroads*	6
Canal boat, improved	10	Magnets, corn	10
Carpetings, etc., printing gold on	5	Materials, resistance of, exp. on	10
Chloral hydrate, simple test for	7	Maxim's gas machine*	1
Chloroforming during sleep	5	Mechanical inventions	7
Corn magnets	10	Natural history notes	7
Dipper, watering, improved*	6	Navigation in fogs*	3
Drowned, perseverance with the	7	Oil tanks, cannonading of	4
Electric lamp, improved*	5	Ore separator, Edison	5
Elephant, baby, takes a bath	7	Photoglyptic process, new	11
Engineering inventions	10	Phyllirhoe Bucephala*	7
Epidemic, strange, a	2	Ruggles, S. P.	7
Exhibition, internation. Sydney*	8	Shower bath, portable, new*	6
Explosions, boiler, prevention of*	4	Slate washer, novel*	5
Fires in New York	11	Specimen, rare, lost	1
Fogs, navigation in*	3	Steamer, little, remarkable	2
Fruit, preserving app. for*	5	Steamers, large, collision between	3
Gas machine, Maxim's*	1	Stevens Institute of Technology	5
Gas making, simple process*	1	Sydney Industrial Exhibition*	8
Genesee Falls, utilization of	5	Tree growth, force of*	7
Geology, report of judges*	8	Trees and shrubs, care of	7
International exhibition, Sydney*	8	Washer, slate, novel*	5
Inventions, agricultural	1	Watches, Am., superiority of	3
Inventions, engineering	10	Watering dipper, improved*	5

TABLE OF CONTENTS OF

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 285,

For the Week ending July 3, 1880.

Price 10 cents. For sale by all newsdealers.

PAGE

I. ENGINEERING AND MECHANICS.—The New Railway up Mount Vesuvius. 6 illustrations. Plan of road.—General view of mountain and railway.—Side view and end view of passenger car.—Mount Vesuvius Railway.—Map showing railway, mountain, crater, and surrounding country.—The carriage road and railway. 4735
The St. Gothard Tunnel.—Notes on the junction of the two galleries. By Dr. CALLADON 4736
The St. Gothard Tunnel.—Conditions and causes of air currents in the tunnel 4736
Protection of Ships from Loss by Fire and from Loss by Sinking. Recent improvements in the construction of ships and steamers.. 4738
Regenerative Stoves.—A Sketch of their History and Notes on their Use. By JOHN W. HARTMAN. An important paper read at the Pittsburg meeting of the American Institute of Mining Engineers. 1 figure 4739
Cowper's Hot Blast Stoves. 2 full page illustrations of hot blast stoves for a pair of furnaces.—Plan and cross section of stove.—Plan and cross section of furnace.—Plan and cross section of gas downcomer.—Sectional elevation of stove and downcomer 4739
Wilson's Lock-up Safety Valve. An important improvement. 10 figures 4742
Working Low Grade Ores 4742
The Largest Concrete Tank in England 4742

II. ELECTRICITY, ETC.—Siemens' Improvements in Electric Railways. 4 figures. Siemens' combined steam and electric railway.—Siemens' electric mail railway 4744
Difference in the Actions of Positive and Negative Electricity.. 4745
Forces Exciting Electricity 4745
The New Electrical Middlings Purifier. By THOS. B. OSBORNE. 5 figures 4744
Physical Society, London. Photo-electricity.—Electrometer key.—Air in water.—Steam thermometer 4745
Atmospheric polarisation. Influence of terrestrial magnetism.. 4745

III. HYGIENE AND MEDICINE.—Lead Poisoning. Clinical lecture by Dr. WM. PEPPER. Effects of a cosmetic of carbonate of lead.—Symptoms of lead poisoning.—Affinity of lead for nerves and muscles.—Treatment of lead poisoning 4745
Recent Investigations of the Blood 4746
The Pulse. Lecture on the pulse in health and disease, by Dr. T. A. MCBRIDE 4746
Some Early Symptoms of Insanity 4747
An Improved Method of Applying Antiseptic Vapors 4747
Treatment of Phthisis by Inhalation of Borax and Salicylic Acid. 4747

IV. CHEMISTRY AND TECHNOLOGY.—Detection of Starch in Cane Sugar. By P. CASAMAJOR 4747
Double Lever Cement Testing Apparatus. 1 figure 4748
Prediction of Chemical Elements 4748
Oil of Sage 4748
Bronzing Iron 4748
Rust Preventing Compound 4748
Argentine Sheep and Wool 4748

V. NATURAL HISTORY, ETC.—Brain of Limulus Polyphemus. General anatomy of the brain.—Internal structure and histology of the brain.—Comparison of the Limulus brain with the brain of other arthropods 4749
An Unfortunate White Whale. A live whale with a broken neck 4749
Ethereal Oil of California Bay Tree. By J. M. STILLMAN 4749
Forest Trees of North America. Prof. Sargent's catalogue (continued from SUPPLEMENT No. 284). Cedars, Red Woods, Firs, Spruces, etc. 4750

THE SUPERIORITY OF AMERICAN WATCHES.

The extract from the report of the judges in horology, at the Sydney International Exhibition, with the diagrams showing the comparative merit of the watches tested, given on other pages of the current issue of the SCIENTIFIC AMERICAN, cannot fail to interest our readers. There were ten exhibitors, and the inherent and comparative merits of the various exhibits were rated under ten heads on the basis of 100 points "for the highest degree of excellence." There were British, German, French, Swiss, and American competitors; and while the scores of the nine European exhibitors footed up totals ranging from 76 to 686, their average being 389½, the total of the Waltham Watch Company was 981. In detail this remarkable score stood thus: Originality, 98; invention and discovery, 95; utility and quality of material, 95; skill in workmanship, 93; fitness for purpose intended, 100; adaptation to public wants, 100; economy, 100; cost, 100; finish and elegance of cases, 100; timekeeping qualities, 100. Total, 981.

The timekeeping tests were made, as the report points out, by Prof. H. C. Russell, Astronomer Royal at the Sydney Observatory; and it is especially noted that while the majority of the watches tested had been made for exhibition purposes, and specially prepared for that end, the exhibit of the American company was the ordinary and regular product of the factory, such as is finished every day. Another evidence of the superiority of the American system, as emphasized in the report, is the fact that a sixth grade Waltham watch, one of the cheapest tested, showed a better performance than many very expensive and otherwise first class watches of other makes.

The moral of the victory is happily drawn in the following editorial review of the contest and its lessons, by the Sydney *Morning Herald* of April 14, last:

"The report of the judges in horology, which we published on Saturday last, was a document of more than ordinary interest. The slightest glance at it will show that the judges brought no small amount of ability and industry to their task. In many other classes of exhibits judging must, to no small extent, be a matter of opinion. There is no absolute test by which one photograph, for example, or one oil painting can be decided to be superior to another. In exhibits of this kind much must be left to the taste of the critic. Watches and chronometers, on the other hand, can be submitted to the minutest tests. The care and trouble which these require are not small, but the issue is sufficiently important to warrant all the labor which the judges in horology brought to their work. Time-keepers that can be relied upon in all weathers and in all climates, and that are within reach of all classes, are a luxury of no common order, but to a large number of persons they are a necessity also. In these fast days, when everything must be done to time, it is for a variety of purposes found necessary to make accurate divisions, not merely of the days and hours, but of the minutes and seconds also. The verdict which the judges in our Exhibition have pronounced on the Waltham watches is one of which any company might be proud; but the facts on which the verdict is based are as interesting to the public at large as to the parties immediately concerned. One of the secrets of American progress lies first in the invention of machinery, and then in its application to almost all descriptions of industry. It is the bringing of machinery to every branch of watchmaking that is enabling Americans to beat the world in this as well as in many other things.

"There has been a general belief that a machine-made watch is not to be compared to one that is hand-made, and that on this account the English watch must always hold its own against the American. This belief will have to be given up, if it is not given up already. It has now been established that machinery can be used for the purposes of watchmaking with quite as much success as for those of agriculture. The Americans are showing that they can make better watches than the Swiss or the English, but, what is of equal importance, they are showing that they can make them for less money. The boast of the Yankees is that they can turn out work cheaper and better than anybody else, and that for that reason the world must take their products. It would be difficult to prove that in some departments the boast is wholly without foundation. The American mechanic is paid better than the English mechanic, and yet the work which he turns out can, as a rule, be sold for less. The reason is, not only that he works harder, but that the assistance of machinery enables him to produce the largest result by the smallest amount of labor.

"Mr. Brassey, who believes that the workmen of his own country are equal if not superior to any in the world, maintains that an English mechanic can do more work than an American mechanic. The American really does more, because the inducements to industry are greater, and because he has better machinery. The success of the Waltham Company has furnished a striking instance of this. This company has now not only well-nigh driven foreign watchmaking companies out of America, but it has shown that it can more than compete with them on their own ground. This arises partly from the fact that it can turn out the best work on a large scale, but also from the fact that the principle on which it operates enables it to do all this economically. The Waltham Company claims to have arrived at simplicity, uniformity, and precision in the manufacture of watches, and the report of our judges shows that its claim is well founded. One of its discoveries was that a simple instrument, where simplicity is possible, will cost less and be worth more than a complicated one. Another was that the making of all instruments of the same grade exactly alike, so that the part which belongs to one belongs to the whole, will not only facilitate manufacture, but will greatly economize it. A third was, that these properties of simplicity and interchangeability are the best guarantees of perfect exactitude. The success which the Americans have reached in this as well as in other branches of industry, ought to excite the gratitude rather than the jealousy of the world. Any company or nation that shows how a maximum of efficiency can be reached by a minimum of labor confers a benefit on mankind. This our American cousins have done in other spheres besides that of watchmaking. There are branches of the prosperity of the Americans that are traceable to the extent of their territory and the fertility of their soil; but the triumph of their machinery has been the result of their inventiveness and of their enterprise, and for that reason it points a moral that Australians might profitably observe."

A REMARKABLE LITTLE STEAMER.

There is soon to set sail from London for New York a new and remarkable little steamer of 70 tons gross burden, named the Anthracite, designed to exhibit the advanced engineering ideas of Mr. Loftus Perkins, of England. The distinctive peculiarities of this steamer are the very high steam pressure that she carries—350 to 500 lb. to the square inch, and the small consumption of fuel—one pound of coal per hour per horse power. A trial trip of this new little boat was lately made of 46 miles, during which 350 lb. steam pressure was steadily maintained, 132 revolutions per minute of propeller, and a speed of eight knots per hour. Other vessels, some of larger size than the above, have been built on the Perkins system, and are running in England. One of them, the yacht Emily, carries 500 lb. boiler pressure. Most of our readers are familiar with Mr. Perkins' system, which has been fully described in our columns. Those who may wish to refer thereto are directed to an interesting article by Mr. Perkins, with engravings, published in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 81, July 21, 1877; also to the description of the steam ferry boat, run on this principle, given with three pages of engravings in our SUPPLEMENT No. 217.

Engineering theory and practice have for a long time plainly pointed to high steam pressures as one of the surest ways to economy of fuel. Twenty five years ago our ocean steamers carried only 16 lb pressure to the inch, and burned 5 to 6 lb. of coal per hour per horse power. To-day they are carrying 75 lb. pressure, and burning 2½ to 3 lb. of coal per hour per horse power.

In 1840 the Britannia, one of the finest steamers of the Cunard line plying between this country and England, burned 5,291 lb. of coal for each ton of paying freight she carried, her speed, then considered fast, being 8½ knots per hour. In 1877 the Britannic, speed 15·6 knots per hour, burned only 551 lb. of coal per ton of freight carried.

Although our present steamers are making fast time and are very economical as compared with the earlier vessels, still it is a lamentable fact that on the largest and finest of them, furnished with all the latest improvements and best appliances to secure economy, worked by the most careful and intelligent engineers, we succeed in putting into our steam only about one tenth of the heat realized in our boiler fire, the remaining nine tenths of the heat being lost. Only in proportion as we make our steam hotter, and expanding it more, shall we economize in fuel. In this respect the voyage of the Anthracite is designed by her owners, we presume, to be an eye-opener for steamboat owners, not only in this country but throughout the world. If a little bit of a boat like this, 84 feet long, 16 feet beam, and 10 feet deep, can carry its own coal and water across the Atlantic, with a pressure of 350 to 500 lb. to the inch, and on one pound of coal per horse power, the natural inference is that our great steamers, when fitted on the same system, will realize far better results. The change from three pounds of coal to one pound per horse power means a saving of two thirds in the coal bill, which is always an enormous item in the expenses of large boats. We ought to add that another peculiarity of the Anthracite is that she uses the same boiler water over and over, only a trifle of fresh water being supplied to make good the slight waste. Our New York steamboat men, who have to pay so dear for Croton water, will be likely to examine the water tank of the Anthracite with interest.

A STRANGE EPIDEMIC.

On the night of Tuesday, June 15, a remarkable epidemic fell upon several towns in western Massachusetts, the town of Adams suffering most severely. Out of a population of 6,000, several hundred—variously estimated from 600 to over 1,000—were prostrated by a disease resembling cholera morbus. The symptoms were first dizziness, then great nausea, followed by vomiting and prolonged purging, and in some cases delirium. A belt of country two or three miles in width and several miles long was thus afflicted, beginning at the west, the whole number of victims being estimated at from 1,200 to 1,500. No deaths are reported.

The cause of the epidemic is not known, but seems most likely to have been atmospheric. For some time the weather had been dry and hot. A heavy local rain fell during the evening, and was followed by or attended with a sudden and great lowering of the temperature. A chilly fog hung over the belt of country invaded by the disease, and a heavy "swampy" odor and taste were in the air.

The malady reached its climax in about twenty-four

hours. It was first suspected that the water supply had been somehow poisoned, but many people who had not used the water were prostrated, while others who used it freely escaped. Adams has hitherto been regarded as an exceptionally healthy town, and the surrounding country is high and wholesome.

CANNONADING OF OIL TANKS.

On the morning of Friday, June 11, lightning struck an oil tank belonging to the Tidioute and Titusville Pipe Line, at Titusville, Pa. The fire thus kindled, raged until Sunday night, consuming 200,000 barrels of oil, crude and refined, and destroying property to the amount of $1,500,000. The most appalling feature in this fire was the successive "boiling over" of oil from burning tanks of the liquid. To empty rapidly a tank containing 20,000 barrels of oil, while the latter is on fire, is no easy matter. The pipes connected with the tanks were utterly inadequate to remove the oil rapidly enough to rob the "boiling over" of its terrors. A happy thought suggested itself on Friday to Mr. D. R. Herron, of the Titusville Battery. Obtaining permission, Mr. Herron brought out one of the Parrott guns of the battery, loaded it with solid shot, and began firing against the three-eighths iron sheets of the distant blazing tank. The first shot glanced, but subsequent volleys pierced the shell of the tank, releasing a large quantity of oil that otherwise would have fed the flames. The battery then moved on to the Emery tank, also burning, and lastly to the Acme tank. Large rents were made in all these, and the liberated oil ran harmlessly down into a stream. This novel target practice greatly shortened the duration of the fire at these tanks, and so drained them that the flames died out for want of fuel, and no "boiling over" resulted.

The peculiar attraction for lightning which these iron oil tanks appear to possess has been several times referred to in our columns. Whenever a thunderstorm passes fairly over one of them it seems to be devoted to destruction. Millions of dollars' worth of property have thus been destroyed. No practical safeguard has yet been suggested.

Ordinary buildings, when properly provided with rods that are well grounded in the earth, are comparatively safe from lightning. Structures made of iron and simply resting upon the earth, without rods, are also exempt from electrical damage. Such structures always present a continuous body of conducting material for the free passage of electricity to earth. Why is it, then, that iron oil tanks form such conspicuous exceptions to our common experience with lightning? Rods put on other structures save them; but rods have been put on oil tanks, masts with rods have surrounded the tanks, but the tanks were exploded by lightning all the same.

We will repeat a possible explanation which we have heretofore given. From every oil tank, according to our theory, there is a constant escape of light hydrocarbon vapor, which forms a permanent cloud or column, rising to a great height above the tanks, far above any rod that could be erected. This vapor rod is a conductor, which the lightning naturally follows, sets on fire the vapor, and explodes the tank.

A column of heated air or vapor rising from a chimney is well known to be a conductor for lightning; the rise of hydrocarbon vapors is illustrated by the balloon.

If the theory we have outlined is correct, the remedy for the electrical explosion of oil tanks is to be found in such a treatment of the oil, or such a construction of tank, as shall prevent any escape of the light vapors.

NAVIGATION IN FOGS.

The disastrous collision of the Sound steamers Narragansett and Stonington was quickly followed by one at sea, by which two great passenger ships escaped instant destruction almost by a hair's breadth.

Shortly after noon, Monday, June 12, the National Line steamship Queen, bound from London to New York, and within 300 miles of her journey's end, ran into the Anchor Line steamship Anchoria, on the way from New York to Glasgow. The bow of the Queen struck the Anchoria on the port side, about twenty feet abaft the foremast, smashing a great hole through the iron hull. Two compartments of the Anchoria filled immediately, but the partitions stood firm, and the other compartments sufficed to keep the vessel afloat. The bow of the Queen was badly crushed, and her forward compartment was flooded. Fortunately the bulkhead proved stanch, and the ship was saved. The fog was very thick, and both ships were going at full speed. It is said that the captain of the Anchoria mistook the whistle of the Queen for that of the Anchoria's companion vessel, the Victoria, which left New York at the same time, and was probably not far away, and before the error was discovered the ships were too close to avoid the catastrophe. Had the sea been rough or the partitions less stanch, both ships must have gone to the bottom almost instantly.

The passengers of the Anchoria were transferred to the Queen, which was least hurt, and the two ships sailed together for New York, arriving Tuesday noon.

These two collisions, coming in such quick succession and imperiling so many lives, give terrible emphasis to the dangers attending navigation in foggy weather. They make very pertinent also the query whether the means now employed for discovering the position and nearness of unseen vessels are at all commensurate with the necessities of the case, or with the means already known, and known to be well calculated to prevent such dangers. In a dense fog the ordinary ship's light is visible scarcely more than a ship's length; and as it proved in the case of the Narragansett and Stonington, the time between thus sighting an approaching vessel and the instant of collision is fatally brief. The recent test of electric headlights for ships in this harbor clearly demonstrated the possibility of projecting a beam of electric light through the densest fog for a thousand feet or more, and through ordinary fogs a distance several times as great.

Except in very rough weather the steam whistle can be heard a long distance, but it is liable to be a treacherous guide. It is not always possible to determine by the ear alone the direction from which a sound comes; and it would seem that a mistake of this nature was made on the Stonington, since the order intended to change her course away from that of the Narragansett only served to precipitate the collision. Had the whistle of the Queen signaled her course it could not have been mistaken for that of a ship sailing in the opposite direction, and the safety of two great floating hotels and their occupants would not have been imperiled thereby.

Means for the better penetration of fogs, for determining the direction of unseen sources of sounds, and for enabling steamers to announce to all within hearing the course they are pursuing, seem therefore to be imperative necessities on shipboard. The first is furnished by the electric headlight, with a system of projection similar to but more efficient than that used on locomotives. The last would be provided by an efficient code of whistle signals to indicate the several points of compass. The second need is supplied by the instrument figured in the accompanying illustration.

PROFESSOR MAYER'S TOPOPHONE.

The aim of the topophone, which was invented and patented by Professor A. M. Mayer, last winter, is to enable the user to determine quickly and surely the exact direction and position of any source of sound. Our figure shows a portable style of the instrument; for use on ship-board it would probably form one of the fixtures of the pilot-house or the "bridge," or both. In most cases arising in sailing through fogs, it would be enough for the captain or pilot to be sure of the exact direction of a fog horn, whistling buoy, or steam whistle; and for this a single aural observation suffices.

Every one has twirled a tuning fork before the ear, and listened to the alternate swelling and sinking of the sound, as the sound waves from one tine re-enforce or counteract those from the other tine. The topophone is based upon the same fact, namely, the power of any sound to augment or destroy another of the same pitch, when ranged so that the sound waves of each act in unison with or in opposition to those of the other.

Briefly described, the topophone consists of two resonators (or any other sound receivers) attached to a connecting bar or shoulder rest. The sound receivers are joined by flexible tubes, which unite for part of their length, and from which ear tubes proceed. One tube, it will be observed, carries a telescopic device by which its length can be varied. When the two resonators face the direction whence a sound comes, so as to receive simultaneously the same sonorous impulse, and are joined by tubes of equal length, the sound waves received from them will necessarily re-enforce each other and the sound will be augmented. If, on the contrary, the resonators being in the same position as regards the source of sound, the resonator tubes differ in length by half the wave length of the sound, the impulse from the one neutralizes that from the other, and the sound is obliterated.

Accordingly, in determining the direction of the source of any sound with this instrument, the observer, guided by the varying intensity of the sound transmitted by the resonators, turns until their openings touch the same sound waves simultaneously, which position he recognizes either by the great augmentation of the sound (when the tube lengths are equal), or by the cessation of sound, when the tubes vary so that the interference of the sound waves is perfect. In either case the determination of the direction of the source of the sound is almost instantaneous, and the two methods may be successively employed as checks upon each other's report.

It is obvious that with such a help the pilot in a fog need never be long in doubt as to the direction of a warning signal; and if need be he can without much delay, by successive observations and a little calculation, determine, approximately at least, the distance of the sounding body.

EFFECT OF AGE ON THE QUALITY OF IRON.

Professor Bauschinger, in 1878, tested iron taken from a chain bridge built in 1829, and found that fifty years of use had not perceptibly altered its quality—either its strength or its elasticity—as reported at the time of its erection. He also examined metal from another bridge built in 1852, and found that the average quality remained as given by Von Pauli at the time of its erection.

Professor Thurston, testing pieces of the wire cable of the Fairmount Suspension Bridge, recently taken down at Philadelphia, after about forty years' use, found the iron to have a tenacity and elasticity and a ductility fully equal to the best wire of same size found in the market to-day.

He therefore concludes that iron subjected to strains such as are met with in properly designed bridges does not deteriorate with age.

A COLLISION BETWEEN LARGE PASSENGER STEAMERS.

During a fog near midnight, June 11, two of the large passenger steamers plying on Long Island Sound, Stonington line, between New York and Boston, came in collision, while running at considerable speed. One of the boats, the Narragansett, was struck near the middle, her side cut open, and a smoke-pipe knocked over, which made a down draught through the furnace, driving out a great sheet of burning gas into the cabins and between decks, by which the vessel was set on fire, at the same time the opening in her side caused her to begin to sink. Some three hundred passengers were on board, and a frightful scene of confusion followed. Happily there was a plentiful supply of life-preservers, some life-rafts, and a few life-boats. There was delay in lowering the boats, but the rafts, life-preservers, chairs, and other floatables served to support most of the unfortunate people, who, to escape the flames, were obliged to leap quickly into the water. About fifty lives were lost; the remainder were rescued by boats from another steamer, the New York, also by help sent from the other damaged vessel, the Stonington.

It seems remarkable that so many were saved. This calamity illustrates the necessity for further effort on the part of inventors to discover new and improved means for fog signaling, saving life, preventing the spread of fires, and keeping vessels afloat. Most of the large local steamers that communicate with New York are veritable palaces, built regardless of expense, and supplied with every known reliable appliance for safety; but the occurrence of accidents like this and their disastrous results show that much remains to be done before navigation, even upon smooth waters, can be considered secure.

The life-rafts of the Narragansett seem to have proved more useful than the life-boats in rescuing the drowning people, the rafts being more quickly and easily launched, requiring less skill, etc.

The upperworks of our river and Sound passenger steamers consist at present of a mass of light, dry woodwork, forming cabins that are very comfortable and commodious for travelers, but highly dangerous in case of fire.

The collision of river steamers above described was followed a few hours later by a collision between two great ocean steamers, accounts of which we give in another column.

Honors to an Aged Chemist.

The chemists of Germany are collecting money for the purpose of presenting a gold medal to Prof. Woehler on his eightieth birthday, which will be July 31, 1880. Prof. Woehler is one of the most distinguished as well as the oldest of living chemists. Himself a pupil of old Berzelius, a contemporary of Liebig, and the loved instructor of many of our best chemists, his name is equally respected on both sides of the Atlantic. Profs. Jay and Chandler, of Columbia College, New York city, two of his former pupils, are receiving contributions from those who wish to join in this well deserved memorial.

Perseverance under Difficulties.

A good lesson to young people inclined to exaggerate the hinderances to their success in life, and to think that their chances are too poor to justify honest exertion, is furnished by a young colored man of Columbus, Ohio, F. P. Williams by name, now serving in that city as census enumerator. Several years ago he was run over by a train of cars, his arms being so mutilated that both had to be taken off near the shoulder. Lacking hands he learned to write legibly by holding his pencil between his teeth. He writes quite rapidly, and in his work as enumerator takes an average of 200 names a day.

MAXIM'S NEW GAS MACHINE.

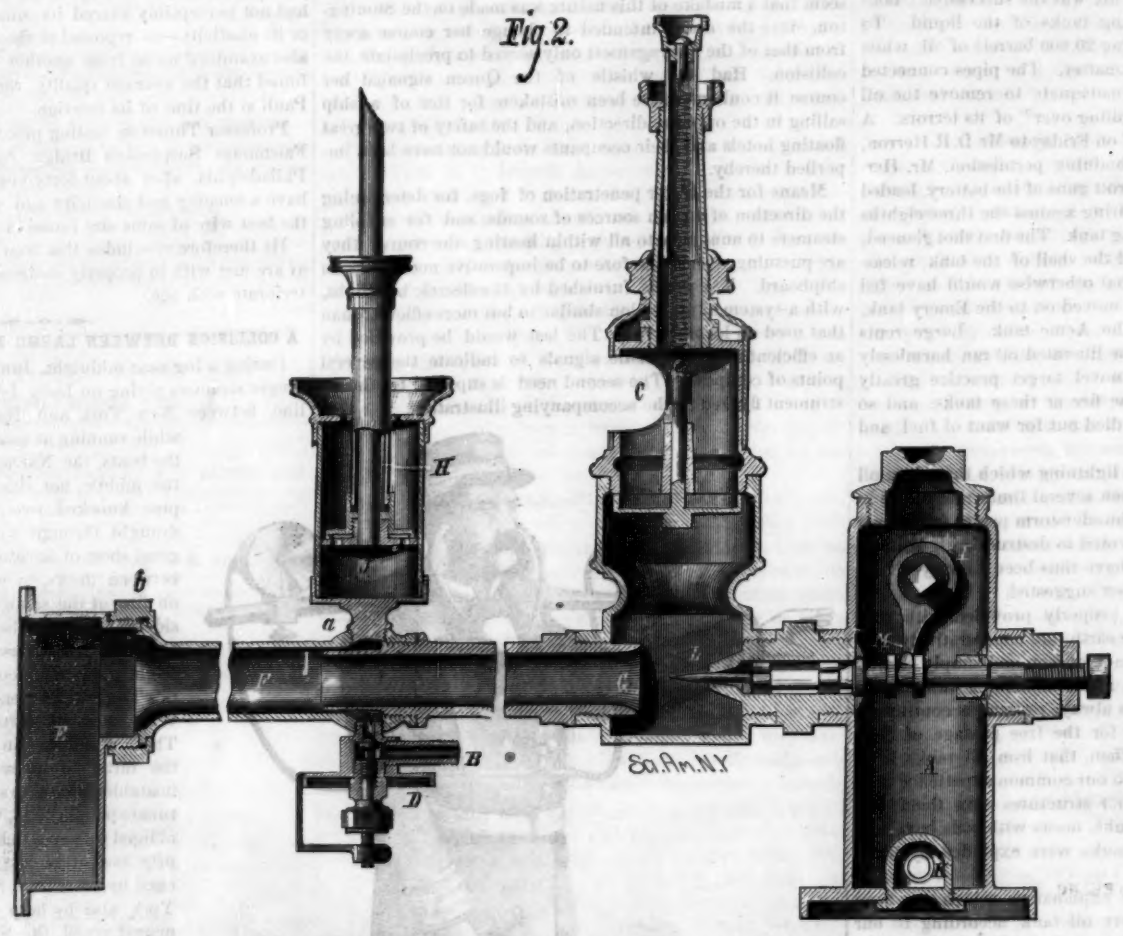
[*Continued from first page.*]

escape through the jet, L. This produces a partial vacuum at L, and draws air in at C. The air and steam pass with great rapidity through the tube, G. The action of the air and steam produces another partial vacuum at N, which draws gasoline in through the pipe, B. The adjustment of the opening is such that one pound of steam draws in air sufficient for two pounds of gasoline. The heat of the steam is taken up by the refrigeration caused by the evaporation of the gasoline, so that at E the compound is carbureted air and cold water. The tube, F, presents the curious phenomenon of being hot at *a* and cold at *b*. In one short piece of tube we have a hot retort and a cold condenser. The supply of gasoline is regulated by the valve, D. The dash pot, H, prevents a too rapid action of the valve, I. Gas of any desired density may be made, and when once adjusted the gas does not vary. The burner used with this machine is made to produce the very best results attainable, and then the gas is regulated to a density and pressure to suit the burner. The nuisance of an adjustable burner is thus obviated.

The holder closes off the supply when full, and lets on a supply when nearly empty. Gasoline has been much improved within a few years. It is now so very cheap that the equivalent of one thousand feet of coal gas of standard quality may be equaled for sixty cents. Where no steam is at hand these machines are run with a small oil burner. They are being made by the Pennsylvania Globe Gas Light Co., 131 Arch St., Philadelphia, Pa., of from 100 to 10,000 burner power.

This machine was patented June 8, 1880.

Fig. 2.



MAXIM'S GAS MACHINE—SECTION OF INJECTOR.

PREVENTION OF BOILER EXPLOSIONS.

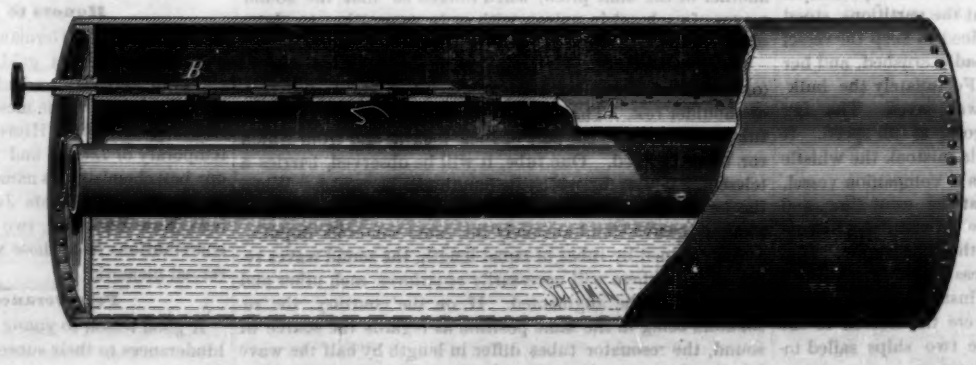
This vexed problem has occupied the minds of engineers and inventors since the introduction of steam as a motive power, and there are several theories of boiler explosions, each having its adherents. Of course there are conditions under which a boiler explosion is involved in no mystery; as, for example, when the water is dangerously low, when the safety valve is of insufficient capacity, or when it is unduly loaded; but there are other cases where an explosion cannot be rationally explained in the light of the well known theories.

Mr. Daniel T. Lawson, of Wellsville, Ohio, has recently patented, in this and several other countries, a device for preventing boiler explosions, which appears practical, and according to the testimony of scientific men the claims of the inventor are well founded.

The inventor, in explaining his invention, says that when water is superheated it becomes as explosive as gunpowder, exploding by bursting into steam from a reduction of pressure. When the engineer opens the throttle valve the cylinder is instantly filled with steam, creating a vacuum to that extent in the boiler. The superheated water then immediately rises to fill the vacuum, and is met by the valve, instantly cutting off the escape into the cylinder; this causes a concussion on every square inch in the boiler much greater than the regular pressure of the steam. There is abundant reason to believe that it is this concussive action which causes the numerous and mysterious boiler explosions, and which cause is wholly independent of the amount of water in the boiler; in fact, the greater the amount of water in the boiler the more terrific the explosion.

This invention, which is based upon this theory, consists in reducing the concussive strain produced by the impulsive and intermittent escape of steam to the cylinders to an approximately uniform pressure, by rendering the evolution or passage of steam from the water to the steam space approximately constant and independent of the intermittent discharges from the steam space to the cylinder. The means for accomplishing this consist in a boiler constructed with a partition, A, intervening between the water space and the space from which the steam is taken to supply the cylinder, and feeding the steam as it is generated through valves or orifices, B, in the partition, of a smaller size than the port or opening through which the steam passes into the cylinder. By this means the normal steam pressure or steam supply, when thus intermittently or alternately reduced, is restored gradually by reducing the flow from the water space to the steam space, so that the transformation of water into steam is made approximately uniform in spite of the intermittent escape of steam through the cylinders, and the boiler is thus relieved of the constant wear and strain of the concussion.

In supplying steam from the water compartment to the steam compartment, the inventor intends using a number of small perforations, not amounting in the aggregate to more than about one twentieth the size of the cylinder port, in connection with a number of small valves to be under control of the engineer, so that the amount of steam required can be readily regulated, yet carefully avoiding the possibility of all, when opened to their utmost capacity, forming as large an opening as the valve through which the cylinder is supplied. A number of small valves and perforations in the partition sheet between the water and steam compartments, will remedy that hitherto very general annoyance of water rising to and through the valves, which is occasioned by pressure of steam upon the surface of the water, and when *one large* valve is opened, the pressure is partly removed from the water immediately under it, consequently the water rises through the valve. A number of small openings for the liberation of steam from the superheated water will remedy this difficulty.



LAWSON'S IMPROVED STEAM BOILER.

MISCELLANEOUS INVENTIONS.

Mr. Niels C. Larsen, of Sacramento, Cal., has patented a purse or satchel fastening which can be securely locked and present a smooth and unbroken surface without projections.

A combined dental speculum and shield has been patented by Mr. Alfred W. Edwards, of New York city. The object of this invention is to facilitate the performance of dental operations, such as the filling of teeth. It consists in a combined dental speculum, gag, and shield formed of a flaring or bonnet-shaped shell of metal, having a longitudinal slot in its lower side to receive the teeth, and an arched wire attached to its lower part, upon the opposite sides of the forward end of the slot, to rest upon the teeth and support the forward part of the shell.

An improved coupling for the shafts of a wagon, which can be readily fastened to or unfastened from the axle, has been patented by Mr. William W. French, of Stockbridge, Mass. The invention consists in the combination with the axle clip and knuckle joint of a sliding bearer and spring catch to facilitate the opening and closing of the coupling.

Mr. Joseph Kintz, of West Meriden, Conn., has patented an improved process for bronzing iron surfaces, which consists in cleaning and buffing the iron surfaces, then electroplating with copper, then dipping in acid solution, then again buffing, then boiling in a salt of tin solution, and then finishing by subjecting the article to heat until the copper and spelter coatings are fused into bronze.

A simple device for extending the steps of passenger cars, for the convenience of passengers getting in and out of the car, and for protecting at the same time the treads of the permanent steps from sparks, cinders, snow, etc., during the passage of the car from one station to another, has been patented by Mr. Benjamin F. Shelabarger, of Hannibal, Mo.

Mr. Luther C. Baldwin, of Manchester, N. H., has patented a new and improved automatic heat regulator, simple in construction and so arranged as to operate, under the smallest changes of temperature, upon the valves of the source of heat.

An improved cigar lighting stand has been patented by Mr. Joseph Kintz, of West Meriden, Conn. This improvement relates to lamp stands for cigar lighting, and has for its object the production of a stand of ornamental character which may be packed closely for transportation and readily put together for use.

A simple, safe, and efficient device in which light oils may be used as fuel for heating sad irons for domestic use, or for the use of tailors, dressmakers, etc., has been patented by Mr. Harvey L. Wells, of Evansville, Ind. It consists essentially of an iron box divided longitudinally into two chambers, the lower being the combustion chamber and the upper the heating chamber.

An improvement in electric light has been patented by Mr. Charles J. Van Depoele, of Detroit, Mich. The object of this invention is to automatically regulate the feed of the carbon in electric lights according to the changes of resistance in the current caused by the consumption of the carbon points, so as to prevent flickering and variations in intensity of the light.

Chloroforming during Sleep.

The possibility of chloroforming a person in sleep, without waking him, having been disputed in a recent murder trial, Dr. J. V. Quimby, of Jersey City, was led to test the question experimentally. The results were presented in a paper before the section of medical jurisprudence at the meeting of the American Medical Association a few days ago. Dr. Quimby made arrangements with a gentleman to enter his room when he was asleep and apply chloroform to him. He did this with entire success, transferring the person from natural to artificial sleep without arousing him. He used about three drachms of Squibb's chloroform, and occupied about seven minutes in the operation. The second case was a boy of thirteen who had refused to take ether for a minor operation. Dr. Quimby advised the mother to give the boy a light supper and put him to bed. She did so, and Dr. Quimby, calling when the boy was asleep, administered the chloroform and performed the operation without awakening the boy. The third case was a boy of ten years suffering from an abscess, and the same course was pursued with equal success. Two important inferences may be drawn from these cases, Dr. Quimby said. Minor surgical operations may be done with perfect safety and much more pleasantly than in the ordinary way, and, secondly, a person somewhat skilled in the use of chloroform may enter a sleeping apartment and administer chloroform with evil intentions while a person is asleep. Hence the use of this drug in the hands of a criminal may become an effective instrument in the accomplishment of his nefarious designs.

IMPROVED WATERING DIPPER.

A convenient vessel for watering plants, sprinkling floors, and for other similar purposes is shown in the annexed engraving. It is simply a dipper of the usual form, partly covered at the top by a shield, at the center of which is fixed a sprinkler spout. The utility of this improvement will be

HARRISON'S WATERING DIPPER.

recognized without further description. It was recently patented by Mr. R. Harrison, of Columbus, Miss.

IMPROVED ELECTRIC LAMP.

The lamp shown in the engraving will be recognized as an Edison lamp, the vacuum globe and the carbon horseshoe being the principal elements. Mr. John H. Guest, a well known electrical inventor of Brooklyn, N. Y., judging from his own experience in fusing platinum with glass in the manufacture of thermostatic fire alarms, concluded that the principal trouble with the Edison lamp would be the entrance of air around the wires passing through the glass of the vacuum globe, devised a simple plan of sealing the joint between the wires and the glass by means of mercury, thus interposing an effectual barrier to the entrance of air at that point.

The invention is so clearly shown in the engraving that scarcely a word of explanation is necessary. In the lamp shown in Fig. 1, the wires that convey the current to the carbon horseshoe are sealed in the ends of curved glass tubes communicating with the globe, and these joints are inclosed in small globes formed on the ends of the glass tubes and filled with mercury.

In this lamp Mr. Guest has made provision partially or wholly preventing the circulation of air, should any remain in the globe after exhaustion with the air pump. The device by which this is accomplished is simply a small globe connected with the lower portion of the lamp globe by a contracted passage, the theory being that the cooler and heavier portion of the air will be drawn into the auxiliary globe by its own gravity.

Fig. 2 shows a lamp in which the tubes that support the wires extend downward into the lamp globe. These tubes at their junction with the vacuum globe are fused to the platinum conducting wires, and the tubes act simply as lateral supports to the wires inside the globe, allowing the wires to expand freely lengthwise. The tubes are sealed outside the globe in the manner shown in Fig. 1.

Another improvement made by Mr. Guest consists in inclosing the ends of the platinum wire conductors in the ends of the material of the carbon before it is carbonized, the wire being formed into a loop to increase the conducting surface and to insure a good connection with the carbon.

Fig. 1.

Fig. 2.

GUEST'S IMPROVED ELECTRIC LAMP.

APPARATUS FOR PRESERVING FRUIT.

The annexed engraving represents a simple apparatus for perserving fruit in its natural state, by means of a partial vacuum. The vessel is especially designed for the purpose, and is provided with an absorbent which takes up whatever moisture may emanate from the fruit. The vessel is preferably made of glass or earthenware, and is provided with a cover having a packing ring and a device for receiving the stems of the fruit. The cover is secured to the vessel by an adjustable screw clamp. In the bottom of the vessel there is an absorbing ring made of burnt or dried clay, which absorbs the moisture escaping from the fruit. The air in the vessel is rarefied either by heat or by the application of an air pump to the opening in the bottom.

FRUIT-PRESERVING APPARATUS.

This apparatus was recently patented by Mr. Carl J. Renz, of Hudson, N. Y.

New Process for Printing Gold and Silver Colors on Carpetings and other Textiles.

(Translated for the *Commercial Bulletin.*)

Gold and silver designs for carpeting and oilcloths have been hitherto prepared in the following manner: The gold or silver were put in leaves or bronze powder on the designs, which were printed with a varnish of linseed oil, or similar adhesive. The bronze thus attached did not possess much firmness, and the method was necessarily expensive. The method recently adopted by Wohlforth is as follows: The bronze powder is united at once to printing material. The liquid silicate of potash, or of oxide of sodium, answers this purpose. One part, by weight, of gold, silver, or bronze powder, along with two parts of the silicate, will give a print color, which is easily transferable by rollers to paper, oilcloth, and woods and metals. The bronze thus printed dries very rapidly, and cannot be taken off by oil or water, unless they are boiling. It bears light and heat equally well, and especially sulphureted hydrogen, which has such a destructive effect on bronzes put on in the form of powder. It is recommended to thin the mass by an addition of warm water, 10 to 20 per cent, so as to keep it from becoming too hard during the process of printing. An addition of glycerine or sirup, of 5 to 10 per cent, will be even preferable. The bronze color remaining on the printing forms can be taken off by warm water.

The Edison Ore Separator Not New

To the Editor of the Scientific American:

In your issue of June 19, 1880, I notice an illustration of an electro-magnetic ore separator invented by Mr. Edison, and patented June 1, 1880.

A device absolutely identical with this has been in use for the past ten or fifteen years at the emery works at Chester, Hampden county, Mass. I there saw it in use myself in November, 1876, and was informed, I think by Mr. Ames that it was not patented, and that no valid patent could be granted upon it by reason of its long continued public use.

My uncle, John S. Williams, of this city, president of the Ore Knob Copper Company, had heard of the machine, and sent me to Chester with a view to purchasing the right to use it at the Ore Knob Copper Works, in Ashe county, North Carolina. On my return to Baltimore I had the magnets constructed by Watts & Co., electricians, on November 24, 1876, for a large machine, similar to the one at Chester, which machine was completed about December 10, 1876, and practically tested at No. 52 Commerce St., Baltimore. It was sent to the Ore Knob Mine about Christmas, 1876, to be used in separating magnetic oxide of iron from the copper ore, and, for aught I know to the contrary, is in use there yet. This is a striking instance of how history repeats itself in inventions. Mr. Edison is doubtless an original inventor of the device, but he most certainly is not the first inventor.

R. D. WILLIAMS.

Baltimore, Md., June, 1880.

NOVEL SLATE WASHER.

Few articles meet with a readier sale or more promptly remunerate the inventor than the class of inventions adapted to the use of children either in their school life or in their amusements. One of these useful little novelties is shown in our engraving. It is a slate washer, consisting of two pieces of metal stamped up so as to form a holder for the sponge at the top and the cloth drier at the bottom. They also form a tubular receptacle containing a supply sponge, which is moistened by removing the corks at the ends.

SMITH'S SLATE WASHER.

This invention was recently patented by Mr. Jacob A. Smith, of Salem, Ohio.

The Utilization of Genesee Falls.

The plan to furnish Rochester, N. Y., with power for manufacturing and for running street cars through the utilization of the falls of the Genesee in compressing air, was described in this paper some weeks ago. All the power of the lower falls, save what is needed to run two wheels for factories already in operation, has been purchased by the inventor of the system, and a promising beginning has been made. According to the Rochester *Union*, a large gang of men are at work building the crib just below the falls on the east side of the river in a cove which seems to have been made by nature for this purpose. This foundation is 100 feet long by 75 feet wide, and will have an average depth of 18 feet. It is being constructed of solid logs of oak timber bolted together, and the center will be filled with stone. On the top of the crib will be erected the derrick, 125 feet high, and the water will pour into it from the top of the falls through the bulkheads at one end of the dam. The stand pipes will run from the top of the derrick to the cylinders on the crib, which will be in the neighborhood of 300 feet long. The whole machinery will be roofed in. The difficulty in the way of getting the materials to the place, they all having to be lowered over the falls, makes the work of construction somewhat slow. It is expected, however, that the first application of the system to the propulsion of street cars will be possible in September next.

Stevens Institute of Technology.

The commencement exercises took place on June 16 and 17, and were of a very interesting nature. On the 16th President Henry Morton delivered an able address before the graduating class on "Popular Fallacies in Engineering." We intend to publish the address in full in our next week's SUPPLEMENT.

NEW PORTABLE SHOWER BATH.

We give herewith perspective and sectional views of an improved portable shower bath, recently patented by Mr. James E. Vansant, of Covington, Ky. It consists of a spherical vessel, having at the bottom a supporting rim which admits of setting it on the floor when occasion requires. The top is provided with a screw cap, perforated with numerous small holes for discharging water in fine streams. In the center of the cover there is a filling tube, which extends nearly to the bottom of the vessel. A float is provided to indicate when the vessel is filled, and shot contained in the two side tubes serves as ballast to keep the device either in an upright or inverted position.

Fig. 1.—VANSANT'S PORTABLE SHOWER BATH.

The vessel is pivoted in a light jointed frame that admits of hanging it up or setting it down. In use it is tipped by means of the cords attached.

Mines and Railroads of Leadville.

To the Editor of the Scientific American:

Nearly every person interested in geology sets up a theory of his own with regard to the carbonate deposits of Leadville, immediately on arriving in this famous district. There is, however, but one theory which has been generally adopted by scientific men, formulated by W. S. Keyes, General Manager of the Chrysolite Iron and Little Chief Mines, and substantiated by the mute testimony of the fossil remains that fix the geologic data. The theory is substantially as follows:

A shallow sea overspread this entire region. An even bed of limestone, dolomitic, was formed by the myriads of shell-fish that subsisted in this shallow sea. From some natural convulsion the waters flowed off, leaving the sedimentary deposits. Subsequently the porphyritic rock flowed over the surface in a pasty mass, covering the limestone. There then followed two processes of ore making. The first was through the mineralizing action of heated and ore depositing waters, coming up out of the depths, and impregnating and permeating the hanging and foot walls of the contact. No free oxygen was contained in these waters; neither did they carry any chlorides or chlorobromides, wherein consists the present richness of Leadville's ores; but in the first process the ore was entirely in the form of sulphurets.

The second process was initiated by the uplifting of the mountain ranges to their present height, at which time the diorites, those ore indicators of the globe, uprose through the sedimentary strata. Thus was the original surface of deposit bent and folded, and not unfrequently entirely broken. The surface waters carrying free oxygen and free carbonic acid now penetrated along the contact, and oxidized the sulphurets, which formed free sulphuric acid, giving rise to the sulphates and sulpho-carbonates. The irresistible law of gravity distributed these sulphates, these oxides, and these carbonates in vast bonanzas, that have been the wonder of the world. The fossil trilobites of this region identify it with the silver lead districts of Nevada, Utah, and Mexico. It is not anomalous, but simply richer than its sister regions to the West and South.

The output of ore from the Leadville mines last year (1879) aggregated 122,483 tons, which represents a value of $11,477,046. That is to say, there was an average yield at $90 per ton, or just $31,443.96 each day. On the first day of May of the present year (1880), the returns from thirty-seven of the leading mines gave a total daily output of 899½ tons of ore, yielding, at the low average of $90 per ton, something like $80,955 per day. The world's history of silver mining in the past shows nothing like this for so young a camp. Scarcely a month passes without opening up some new and vast carbonate deposits. The territory has not even been thoroughly prospected; and the future yield of the royal metal will far eclipse its past production.

It might not be uninteresting in this connection to give something regarding the sampling and milling of ores. One of the most complete concerns engaged in this business anywhere in the country is that of Augustus R. Meyer & Co. This establishment has grown with the growth and development of this carbonate district. The business was first established as long ago as the year 1877 (before Little Pittsburg was dreamed of). A little log house, a relic of seventeen years previous, was found sufficiently ample for the needs of the business of that period. However, it was not long before additions had to be made and new buildings erected. In the year 1879 the present company was incorporated with a capital stock of $50,000, and every preparation that money and business sagacity could effect was made to meet the demands of the prosperous era, that has built a mining metropolis 10,240 feet above the sea level, at the base of the great continental divide. As at present constituted the premises of the company comprise seven and one-half acres of ground, upon which six buildings have been erected, including ore houses and crushing and sampling buildings. During the busy season of summer from thirty-five to forty men are employed, who alternate their work in two shifts, day and night. At this season it frequently happens that the ore houses, which hold 1,500 tons, are insufficient for the accommodation of the mineral sent from the mines to be crushed, and large quantities have to be stored outside. In sampling ores from the various mines about Leadville this establishment pursues the most careful methods. The different ores are first deposited in large bins holding from 25 to 100 tons. One-tenth of each load is taken and run through a Dodge crusher, which well adapts it for the furnaces. A fifth of the tenth already indicated is put through heavy rollers, and one half of this finely crushed ore is subjected to the Bucking hammer and powdered to an eighty-sieve grade. One sample of this powder, consisting of a fourth, is given to the miner, two samples are kept for reference, and the other is sent to the assayer, who takes his "assay ton," upon which the company buys and sells. The capacity of the works are all the way from 80 to 150 tons per day. For samples, $7.50 is charged for silver and lead per ton, and $10 per ton for gold; but in large quantities a less charge is made. In job crushing, the market value of silver is allowed, with from five to ten per cent deducted. The Meyer works enjoy an excellent patronage from the best mines of the camp, including such as the Chrysolite, Carbonate, Vulture, Duncan, Matchless, Climax, Morning Star, Crescent, and J. D. Dana, some of which have all their crushing done at these sampling works.

RAILROADS.

In order to furnish better transportation facilities for the mineral of this district, and to emancipate it from the freight embargo that has virtually fettered its commerce, citizens of

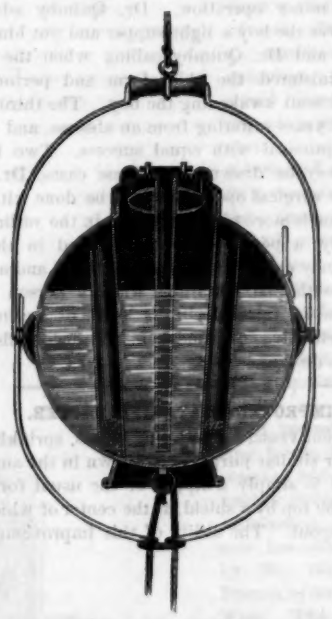


Fig. 2.—SECTION OF SHOWER BATH.

Leadville have determined to construct a broad gauge railway down the Arkansas Valley to Pueblo. This will enable Leadville merchants to ship goods through from the East without breaking bulk, and lay them down in their warehouses as cheaply as the same commodities could be laid down in Denver. This will insure Leadville the control of the business of the Gunnison country, whose mineral developments are spoken of in the highest terms. Propositions from Eastern railroad contractors have already been received, preliminary surveys have been made, and $200,000 guaranteed to the stock subscription. It now seems to be only a question of what method to pursue in constructing the road.

Growing out of the broad gauge movement, to some extent, two or three narrow gauge enterprises have been organized. One is projected from Leadville to Salt Lake City, following the carbonate belt, as shown in Hayden's Geological Map, around through the Eagle River, Roaring Fork, and White River Agency districts, into Utah. Such men as H. A. W. Tabor and C. B. Rustin stand at the head of this project. Another narrow gauge road is organized to be built into the "Ten-Mile" and Breckenridge districts, where the famous Robinson Mine is located. Should the broad gauge be built this summer to Pueblo, there is little doubt but that narrow gauges would ramify out from Leadville into every mineral bearing gulch that was found accessible. W.

Leadville, May 6, 1880.

AUGUSTUS R. MEYER AND COMPANY'S ORE MILL.

MECHANICAL INVENTIONS.

Mr. William B. Hickman, of Sterling, Kan., has patented a swage to be used in welding the triangular bar which is to form the flange of a plow point or share to the body of the same.

Mr. Lucius S. Edleblute, of Cincinnati, O., has recently patented what he calls the rubber cushioned spoke and hub. This is an improvement in the class of vehicle wheel hubs having an elastic band or annular portion which surrounds the journal box and on which the butts of the spokes rest, so that the wheel is rendered elastic and more durable, also comparatively noiseless when running on stony pavements, roads, or streets.

Mr. George Richards, of Roxbury, Mass., has patented a steam muffler composed of two plates of a diameter very much greater than the diameter of the pipe through which the steam escapes from the boiler, so that the steam has room to expand before escaping to the outer air, its expansion effectually deadening the noise caused by the passage through the contracted escape pipe.

The Baby Elephant takes a Bath.

It is customary with traveling menageries in hot weather when convenient to a river to allow the elephants to take a bath. The London Circus passed through Woonsocket, R. I., the other day, when the keeper let loose all the elephants, including "Hebe" and her baby, for the above purpose. The mother and her offspring were permitted to approach a river for the first time since the baby was born, and they were, therefore, watched with great interest by their keeper. The mother cautiously approached the Blackstone River, which flows past the circus grounds, and waded in a short distance, carefully feeling her way; she then encouraged the baby to follow her, which the obedient little fellow did. When far enough in the mother caught the baby between her fore legs, and then lay down in the water and rolled over, giving the baby the first bath. The mother then felt perfectly satisfied with her job, and rising up approached the bank, bringing the little one with her. On reaching terra firma she drove the younger before her, and would not allow it to approach the water again, though it showed a disposition to do so.

PHYLLIRHOE BUCEPHALA.

This little animal belongs to the family of snails, class Heteropoda, is about an inch long, and is devoid of any shell or covering whatever. It is flat, and so absolutely transparent that a person can read through its body. It is provided with a pair of feelers. The little animal is very luminous if placed in fresh water or disturbed, but this phenomenon is most beautiful when an ammonia solution is poured over the animal. It will shine with a vivid blue light, which extinguishes with life. But even after death the nerve cells, which are directly below the skin and produce the light, can be irritated sufficiently to become luminous. It is a singular fact that electricity has no effect upon these nerve cells.

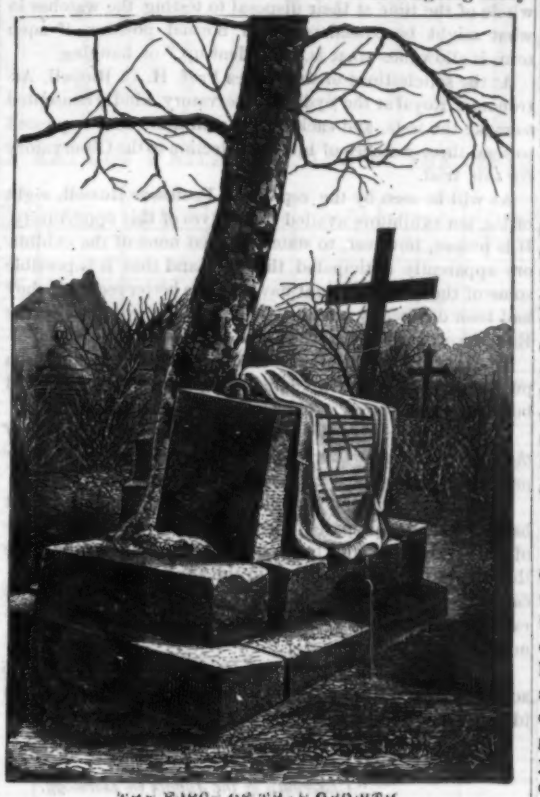
Care of Trees and Shrubs.

In view of the drought which prevails in many parts of the country and its unusual severity over extensive districts, the *Rural New Yorker* suggests to those who have planted trees or shrubs the past spring that there is one method, and so far as we know, says the writer, only one, by which they may be protected against injury or death from that cause. Surface watering has been shown to do more harm than good. The ground is made hard and compact, thus becoming a better conductor of heat while it becomes less pervious to air and moisture. A portion of the surface soil should be removed, and then pailful after pailful of water thrown in until the ground, to a depth of two feet and to a width about the stem of not less than three feet in diameter, has become saturated. Then, as soon as the water has disappeared from the surface, the removed soil should be well pulverized and returned. A covering of boards, straw, or hay, or even of sand or gravel, may then be applied, and the tree or shrub, thus treated, will pass through ten days of additional drought in safety.

As soon as rain comes to wet the earth thoroughly, we think it is better to remove the mulch. Nothing is then gained by permitting it to remain. Mellowing the surface soil about the trees, thus keeping it free from grass and weeds, is then the most that is needed. We would repeat that the present is the season when the female borer deposits her eggs on the stems of fruit trees, and the wash of lime, potash, sulphur, etc. (darkened with lamp black), should now be applied and reapplied during June and July, as soon as washed off by rain.

THE FORCE OF TREE GROWTH.

The disruptive power of tree roots, growing in the crevices of rocks, is well known. Masses of stone weighing many

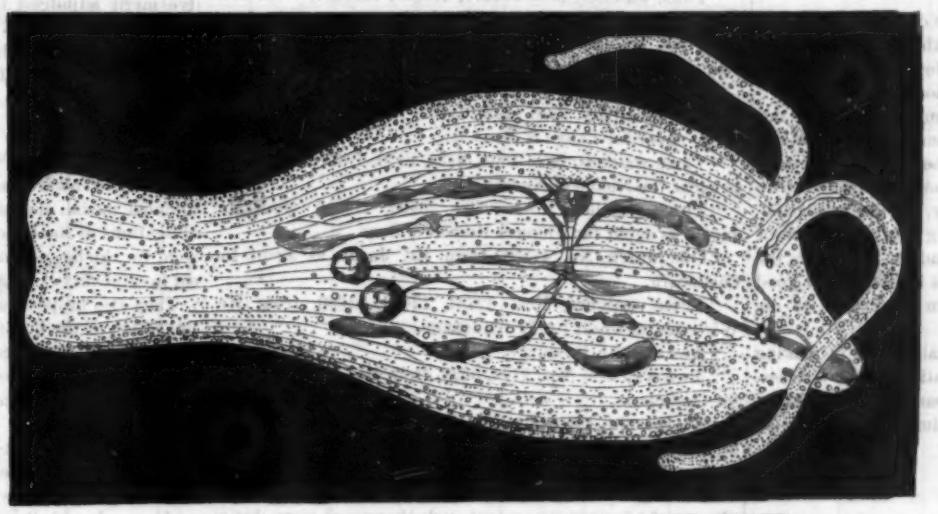


THE FORCE OF TREE GROWTH.

tons are often dislodged in this way from the faces of cliffs, and no one gives them more than a passing glance. When, however, the sanctity of the tomb is invaded, despite the graven warning of the occupant, the case is very different, and superstitious people are apt to think there must be something in it more than accident and the unconscious expression of the resistless force of growing vegetation.

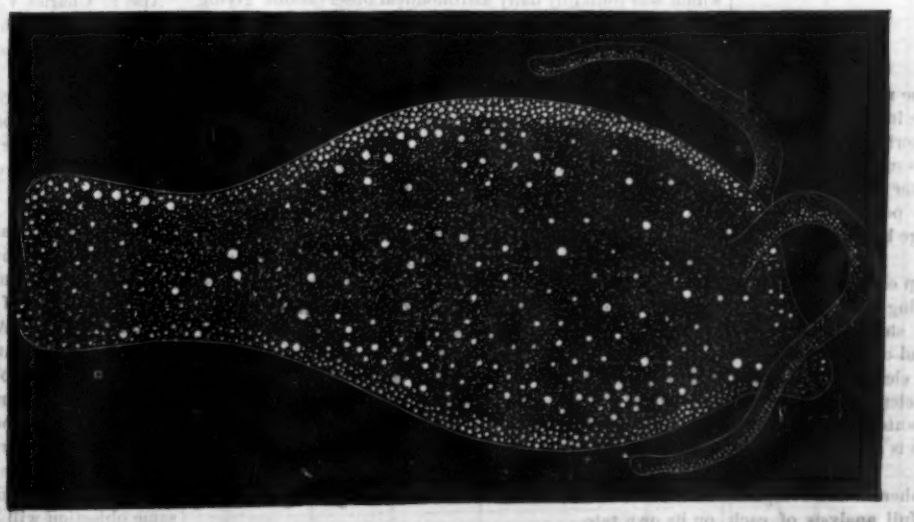
The engraving herewith is copied from a photograph sent to us by a European correspondent, of a grave in the Garten churchyard, in Hanover, Germany, the invasion of which by a birch tree has been the occasion of much wonderment by country people, who come from great distances to examine it.

The monument, so unfeelingly disrupted, was erected in 1782, and bears on its base the following inscription: "This grave, which was bought for all eternity, must never be opened." A chance birch seed, lodging in a crevice of the monument, has displayed the irony of nature in slowly yet surely thwarting the desire of the person who designed it for a perpetual memorial. All the joints are separated, the strong iron clamps are broken, and the birch tree has embraced the upper large block, which weighs about one and a quarter tons, and the tree is driving its roots below, gradually but surely tilting the structure.



PHYLLIRHOE BUCEPHALA—AS SEEN IN THE LIGHT.

a b, ganglion; *c*, intestines; *d*, liver; *f*, kidneys; *g*, generative organs.



PHYLLIRHOE BUCEPHALA—SHOWING IN THE DARK THE LUMINOUS SPOTS.

Perseverance with the Drowned.

In a recent communication to the French Academy, Professor Fort asserts that he was enabled to restore to life a child three years old, by practicing artificial respiration on it four hours, commencing three hours and a half after apparent death. He mentions also a case in which Dr. Fournol, of Billancourt, reanimated, in July, 1878, an apparently drowned person by four hours of artificial respiration begun one hour after the patient was taken from the water. At this season, when cases of drowning are apt to be frequent, the possible benefit that may come from a persevering effort to revive victims of drowning, should encourage friends not to despair of their resuscitation, even after several hours of seemingly fruitless labor.

Simple Test for Chloral Hydrate.

A new test for chloral hydrate has been devised by Frank Ogston, namely, yellow sulphide of ammonium. On adding this reagent to a solution of chloral of moderate strength there is at first no change noticed, but in a short time the colorless solution acquires an orange yellow color, and on longer standing turns brown and evolves a gas of very disagreeable odor. Ogston's experiments show that a solution containing ten milligrammes turns brown in six hours, and gives the peculiar odor. With one milligramme the orange-yellow color appears in twelve hours, but no odor. Croton chloral gives the same reactions, but chloroform, chloric ether, and formic acid do not.

NATURAL HISTORY NOTES.

The Propagation of Oysters.—At the recent meeting in this city of the American Fish Cultural Association, a paper was read on the propagation of the oyster, by Dr. W. J. Brook, of the Johns Hopkins University. The manner in which this propagation takes place had never before, he said, been thoroughly understood. Through studies made by him last summer, however, great light was thrown on the subject. He found that the American oysters do not breed their young in the shell, as had been supposed, and that consequently the eggs can be impregnated artificially. An average oyster contains from six to nine million eggs, and one of large size may contain fifty millions. The plan pursued by him in fertilizing these eggs was to chop the male and female oyster up together; thus the fluids are mixed and the impregnation is made complete. The process of development immediately begins, and goes on so rapidly that a change may be noted every fifteen seconds. In a very few hours the embryo is sufficiently formed to swim in the water. The shells at first are very small, and are not adjacent to each other. They grow very rapidly, closing down over the sides, and finally unite and form the hinge. In the short space of twenty-four hours the young oyster is able to take food, and from three days to a week it attains perfect form. During its early life it is a swimming animal. The oyster is able to reproduce its species at the end of a year's growth, and it is marketable at the age of three years.

S. P. Ruggles.

S. P. Ruggles died at Lisbon, N. H., May 28. He was principally known as the inventor of the Ruggles printing press, which was among the first of machine presses. His invention was what printers call an "upside-down press," the type being upside down when in the bed. About twenty-five years ago Mr. Ruggles sold out his interest for nearly $200,000, and since then has not been in active business. He was the inventor of the raised alphabet for the blind, and always showed great interest in the amelioration of the condition of the sightless. He was also a great friend of mechanical education, and has written much on the subject.

SYDNEY INTERNATIONAL EXHIBITION.—1879-1880.

Extracts from the Report of the Judges in Horology.

DEPARTMENT III.—EDUCATION AND SCIENCE.

Group—Scientific and Philosophical Instruments and Methods.

Class 310.—Chronometric Apparatus, Chronometers, Astronomical Clocks, Watches, Chronographs, etc., etc.

Judges.—John McGarvie Smith, New South Wales.*
P. E. Bound, Switzerland.
H. C. Russell, B.A., F.R.A.S., Great Britain.
E. Beckmann, Germany.
Gregory P. Harte, United States.

To the Honorable Committee on Judging and Awards, Sydney International Exhibition.

GENTLEMEN: I have the honor to hand you herewith the report of the judges of Class 310, as above,

And remain, sirs, your obedient servant,

GREGORY P. HARTE, *Chairman.*

The following exhibits were submitted for examination:

U. S. Exhibit, 537, American Watch Company, Waltham, Mass., U. S. A.—Watches and Chronographs.

British Exhibit, 1,048, Victor Kullberg, London, England—Watches and Chronographs.

British Exhibit, 1,054, Nicole & Nielsen, London, England—Watches, Chronographs, etc.

British Exhibit, 1,060, T. Russell & Sons, London, England—Watches, Chronographs, etc.

British Exhibit, 1,041, Castleberg & Co., London, England—Watches, etc.

British Exhibit, 1,060a, S. Backschmid, Switzerland—Watches.

. . . . . .

German Exhibit, 36, A. Lange & Sons, Dresden, Germany—Watches, etc.

Swiss Exhibit, L. Audemars, Brassus, Switzerland—Watches, etc.

French Exhibit, 146, A. H. Rodanet, Paris, France—Chronometers.

French Exhibit, 177, G. Tribandeau, Besançon, France—Watches.

Swiss Exhibit, 14a, International Watch Company—Watches.

In presenting the following report, the judges desire to make some explanations, which, we trust, will excuse them in the minds of the impartial for any apparent neglect in the form of their report, and for the limited number of tests made of the horological exhibits.

The judges were appointed too late to do the full amount required, inasmuch as the number of exhibits was so much in excess of any reasonable allotment for examination and report before the closing of the Exhibition.

Commencing their labors, however, immediately after the first call, the examinations were not complete until March 3d, which only permitted a time test to be made of nine days in a single position. This single position was objected to by some of the exhibitors, but ill-advisedly, for the ratings observed in the watches of the objecting exhibitors were of such character as to establish in the minds of the judges the conclusion that their watches would not have made so good a comparative showing if there had been more time to observe the ratings in other positions.

Great care was taken by the individual judges in making up their note books during the examination of the watches, and scrutinizing the inherent and comparative merits of exhibits under the ten different heads unanimously agreed upon, as follows:

1. Originality.
2. Invention and discovery.
3. Utility and quality of material.
4. Skill in workmanship.
5. Fitness for purposes intended.
6. Adaptation to public wants.
7. Economy.
8. Cost.
9. Finish and elegance of cases.
10. Time-keeping qualities.

It was agreed the judges should use the number 100 as expressing the highest degree of excellence in each of these ten elements of inherent and comparative merit, and adjudge individually to each of the several exhibits such rating as their respective judgments would warrant after careful examination; each set of opinions being made a portion of this report, and in the *résumé* the mean average being taken as the unanimous verdict of the judges.

It was also decided we should take up each exhibit in the order originally examined, and, beginning with the first element of merit (originality), each judge should in numbers express his judgment of the inherent and comparative merit attaching to each exhibit in this one element; this being done, to proceed with each succeeding element in order and in the same manner. The five judgments being complete and in numbers, the aggregated verdict is arrived at simply by addition and division.

This is not only a verdict as to the inherent and comparative merits of each exhibit, but also a full analysis of each order of merit in any exhibit as compared with all the others.

In giving this verdict it was absolutely necessary to ascertain to the fullest extent the time-keeping qualities of the exhibits. The judges were led to this conclusion from the fact that in some of the exhibits we were shown watches of equal finish containing every known application of horological science in practically the same construction, which should, as far as they could determine by merely optical examination, keep quite as good time as watches of double and treble the costs in other exhibits, thus involving their judgment in doubt upon several elements of merit.

In justice to themselves and to the exhibitors the judges determined to make the test in only one position, and give the whole of the time at their disposal to testing the watches in what might be considered their normal position, if such term is allowable—that is, "pendent up," or hanging.

At the solicitations of the judges Prof. H. C. Russell, Astronomer Royal at the Sydney Observatory, kindly consented to make the tests, and each of the exhibitors was requested to send three watches of his own selection to the Observatory for this trial.

As will be seen by the report of Professor Russell, eight of the ten exhibitors availed themselves of this opportunity. It is proper, however, to state here that none of the exhibitors apparently anticipated this test, and that it is possible some of the watches might have made a better record if they had been differently attended to since the opening of the Exhibition; but they were in this respect all upon a par.

The majority of the watches had been made for exhibition purposes and specially prepared to that end; and some had been previously rated at observatories before sending.

Notably, however, to the contrary of the above, the exhibit of the American Watch Company was the ordinary and regular product of the factory, such as is finished every day.

Notwithstanding the possibility that these exhibits might have been better prepared for observatory time tests, some of the exhibits, as will be seen by the rating, demonstrate the wonderful advances made in the application of horological sciences to the manufacture of watches, and that their rating is being made equal to that of the best marine chronometers.

The following is the report of Professor Russell, and the accompanying diagram (see next page) will readily give an idea of the comparative performance of the different watches.

"Sydney Observatory, 26th February, 1880.

"GREGORY P. HARTE, ESQ.,

"Chairman of the Judges in Horology.

"SIR: I have the honor to report that, in response to your circular, inviting exhibitors of watches each to send three watches to the Observatory to be tested, I received on Monday, February 16th:

"Three watches, Nos. 611, 669, 237, from Mr. Dolman, agent for Mr. Tribandeau, Besançon.

"Three watches, Nos. 987271, 670068, 1221336, from Mr. Manson, agent for Waltham Watch Company.

"Three watches, Nos. 3171, 1935, 2526, from Mr. Allerding, agent for Mr. Kullberg.

"And on the forenoon of February 17th:

"Three watches, Nos. 11527, 19967, 12629, from Mr. Hoffnung, agent for Lange & Sons.

"Three watches, Nos. 1004, 8632, 8370, from Mr. Jacob, as agent for Nicole & Nielsen.

"Three watches, Nos. 70690, 23496, 113516, from Mr. Jacob, as agent for Thomas Russell & Sons.

"One watch, No. 47150, from Mr. Jacob, as agent for Castleberg.

"Three watches, Nos. 12731, 12483, 11680, from Mr. Wiesener, as agent for L. Audemars.

"And on 18th February:

"Two watches, Nos. 3724, 3538, from Mr. Jacob, as agent for Castleberg.

"On the 17th I began rating these watches, keeping them all in one position (hanging), and subject to the same conditions of temperature; in fact, they were all hung on one board, and kept in a compartment locked up so as to avoid change of temperature, except such changes as were due to changes in the weather.

"They were rated once a day by the standard clock, which affords special convenience for this work, and the error of which was found by daily astronomical observations giving the absolute time; great care was taken in rating so as to get the exact error of each watch every day, care being taken at the same time to avoid errors in the seconds dials, a fault sufficiently obvious in some of these exhibits.

"In presenting the result of this test in the form of a diagram (see diagram on the opposite page), it is necessary to explain that the curves show only the change of rate in each case, and nothing is shown here of the actual rate, which was large in several instances.

"In the diagram spaces between faint lines represent seconds; and the thicker faint lines represent the mean rate in each case: When the curve rises it shows that the watch was gaining on its previous rate, and when it falls the watch was losing on its previous rate. For example, in No. 4 curve the thicker line shows the position of a gaining rate of 3 sec. per day; on the 18th, watch No. 4 had a gaining rate of 2·7 sec., and is plotted below the thick line; on the 19th and 20th it was less than 3 sec., but on the 21st the rate increased to 4·8 sec., and the curve rises above the line. The same rule is followed with losing rates; and, therefore, each curve shows whether the watch was gaining or losing on its own rate.

"For convenient reference the barometer and temperature curves are plotted on the same sheet; although from the short time at command the watches could only be tested in one position, a glance at the diagram will show that in some degree at least the temperature adjustment and the isochronal properties of the balance springs were also tested; and I wish to call your attention to the fact that the whole of these watches show in a more or less degree a marked response to the change in temperature, some being over and others under corrected.

"This fact is important, because it adds another proof that the old form of compensation balance—even when combined with chronometer spring and escapement and all the refinements which the best modern workman can add to it—fails to yield a complete correction for temperature; and I much regret that the American Watch Company, who claim to have overcome this fault by means of a balance involving a new arrangement of the metals, did not send to be tested any of their first-class watches containing this important improvement.

"Several of the rate curves, especially Nos. 4, 10, 13, 16, 21, and 24, respond to the change in the barometer in a way that shows the isochronal properties of their balance springs are not quite perfect. *Looking down the curves it becomes at once evident that watch No. 5, which is No. 670068, second grade of the American Watch Company, is remarkably free from these defects, and presents the best rate of all the watches tested.* No. 9, which is No. 2526, Kullberg, is the nearest approach to No. 5; indeed, the difference between its highest and lowest rates is 0·1 sec. less than No. 5, but it has not such a steady rate. The timekeeping of both these watches is remarkably good, and shows that we have entered upon a new era in the manufacture of pocket chronometers; *for these rates are better than the majority of marine chronometers.*

"*Among the cheaper watches tested, No. 6, which is No. 1221336, of the American Watch Company, is worthy of notice; it is a watch of the sixth grade, yet its performance has been better than that of many very expensive and otherwise first-class watches among those tested; such a watch speaks volumes in favor of the system under which it was made, and is the best comment upon the accuracy of the machines that produced it.*

"There are several watches among those tested which have kept wonderfully steady rates, but their comparative merit is shown in the diagrams much better than it could be by any description. The daily rate of each watch will be found in a table attached.

"The changes in Nos. 1, 2, 3, 17, and 19 were too great to plot.

"H. C. RUSSELL,

"Government Astronomer."

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CONCLUSION OF THE REPORT.

In consideration of the facts developed in this examination, and the preponderance of elements of inherent and comparative merit adjudged by the judges (each in independent judgment) being equal to nearly 70 per cent more than the next highest exhibit, they have found it exceedingly difficult to make such a classification in degree as will give even-handed justice to all.

We adjudge to the

AMERICAN WATCH COMPANY, OF WALTHAM, MASS., U. S. A.,

a first-class award, and such other special distinction, diploma, medal, or award, as is consistent with the duties and obligations of the honorable Sydney International Commission, for the largest and most complete exhibit of horological instruments examined.

They also propose, as the only means by which their appreciation of the merits of the production of this company can be adequately or equitably recognized by the Committee on Judging and Awards, that a separate first-class award be given for the timekeeping qualities of all grades of these watches.

Also a separate first-class award for the perfection of this system of watchmaking and the improvements in the mechanical parts of the watch, being notably in the main spring and going barrel, the patent safety pinion, the perfect epicycloidal form of all the teeth of the train, in every grade of watch alike, and the isochronal adjustment of the balance spring.

Also to Charles V. Woerd, mechanical superintendent of the American Watch Company, Waltham, Mass., U. S. A., a first-class award for his new mode of compensating balances.

Also a separate first-class award for the improvements in cases, the number of artistic forms and designs used, the beauty and elegance of their finish, and for their new and indestructible method of enameling.

VICTOR KULLBERG

The display of marine chronometers by this maker, with the Observatory ratings, was of the very first order. Every part of those instruments was remarkably well made, and the modifications of some of the balance wheels worthy of special attention. Adjudged a first-class award.

The display of watches by the same maker, although small, commanded attention from their very nice finish in all parts. As will be seen from the report and diagram of Professor Russell, they are good timekeepers, especially the one having the chronometer escapement. This style of watch, however, is of too delicate construction and too costly to fully meet the requirements of any considerable public want. The same objection will hold good as to the lever escapements as far as cost or economy is concerned, they being comparatively too high priced. Representing a certain class of manufacture, they are of the first order of merit, and adjudged a first-class award.

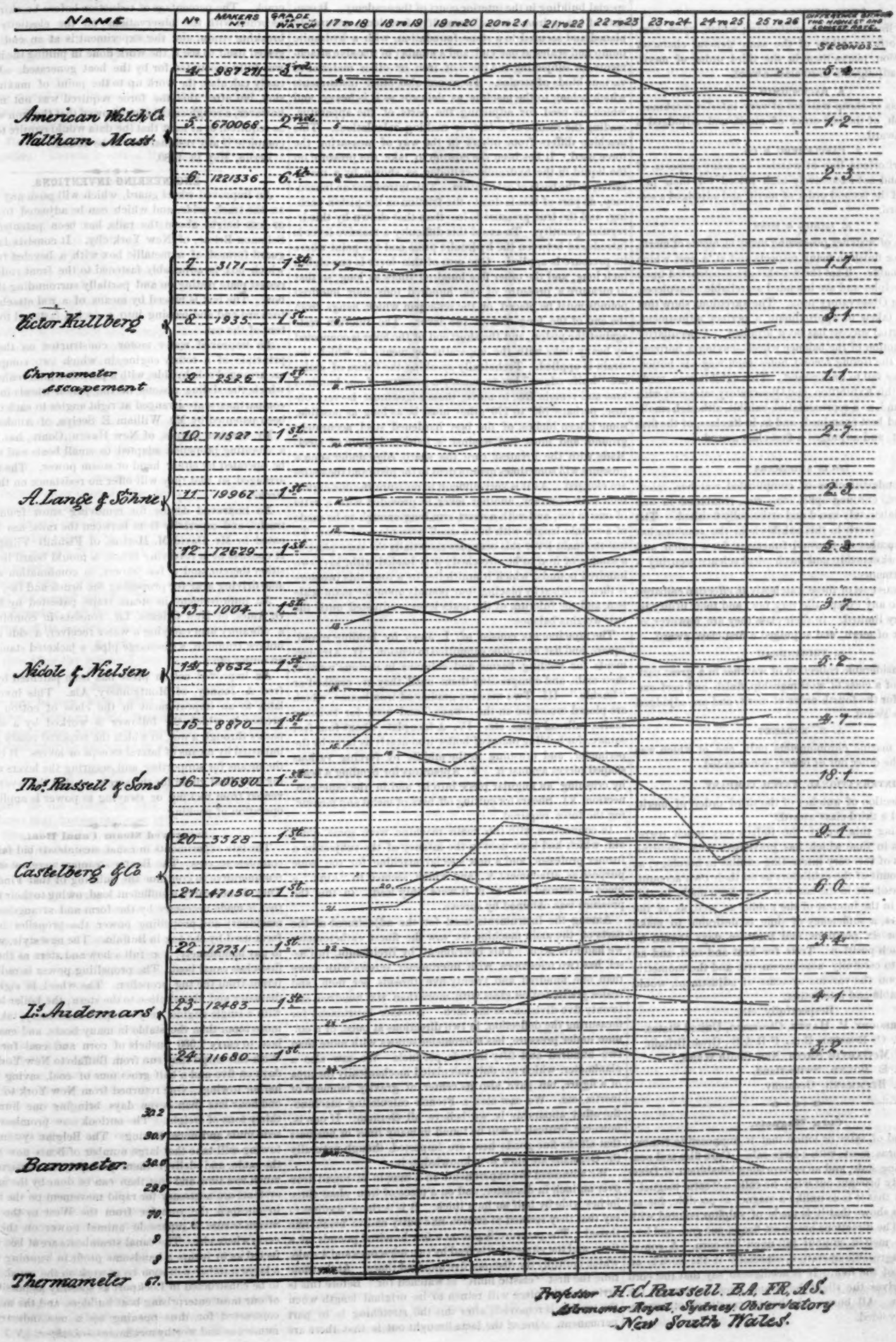
The "gas governor" exhibited by the same maker, an instrument for regulating the amount of heat in the testing of chronometers, is commended as a useful invention.

[*Continued on page* 10.]

RESUME OF THE JURY'S EXAMINATION.

NAMES OF EXHIBITORS.	Originality.	Invention and discovery.	Utility and quality of material.	Skill in workmanship.	Fitness for purposes intended.	Adaptation to public wants.	Economy.	Cost.	Finish and elegance of cases.	Timekeeping qualities.	Totals.
AMERICAN WATCH COMPANY, WALTHAM	98	95	95	93	100	100	100	100	100	100	981
Victor Kullberg	0	0	73	80	89	88	87	65	73	96	568
Nicole & Nielsen	28	22	47	58	70	60	48	88	76	80	577
Thos. Russell & Sons	8	0	25	80	56	84	22	25	42	44	307
Castleberg & Company	0	0	29	39	36	41	25	32	42	53	298
S. Backschmid	0	0	11	11	7	15	12	10	10	0	76
A. Lange & Sons	45	33	68	82	86	73	59	79	71	89	685
Louis Audemars	98	24	73	85	80	54	44	58	78	79	671
G. Tritandeau	0	0	10	19	15	15	18	19	20	0	116
International Watch Company	0	0	32	31	37	49	41	63	34	0	287

FACSIMILE DIAGRAM SHOWING THE CHANGE IN RATE OF WATCHES TESTED AT THE OBSERVATORY, SYDNEY, FEBRUARY 17 TO 26, 1880.



SYDNEY INTERNATIONAL EXHIBITION.

[*Continued from page 8.*]

NICOLE & NIELSEN.

This exhibit, made specially for the Exhibition, comprised a full line of plain levers, split seconds, chronographs, calendars, repeaters, etc., and was a representative display of their peculiar style of manufacture in all its details. The cost of these watches, compared with others of similar construction and finish, was excessive; and while they show good timekeeping qualities, they do not equal that of other exhibits.

As representing their own methods of construction they are of the first order of merit, and are adjudged a first-class award.

THOS. RUSSELL & SONS

exhibit a full line of their manufacture, which, upon comparison with other exhibits of the same general character and construction, places them in the third order of merit, and they are adjudged a third-class award.

S. BACKSCHMID

exhibits a class of cheap watches of very inferior workmanship and finish, of the last order of merit, and adjudged a fourth-class award.

N. CASTLEBERG & CO.

exhibit a meritorious line of watches in many respects, of good finish, and not excessively high priced for their performances; of the second order of merit, and adjudged a second-class award.

A. LANGE & SONS

exhibit a class of watches possessing many elements of merit, and of superior finish in many respects and at a cost which is quite reasonable. That the watches are constructed upon scientific principles and are intended as reliable timepieces, is shown from Observatory tests. The variations show that care has been taken to approximate a perfect adjustment, and that a partial success has been attained. A peculiarity in the construction of the balance wheel—having a horizontal split from the timing second holes each way—is noticeable, which we fail to understand. This exhibit was made expressly for this Exhibition, and Observatory rates sent with each watch, and, as a representative exhibit, although small, was the second best examined, and is, in its class, of the first order of merit, and adjudged a first-class award.

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LOUIS AUDEMARS

exhibits a wonderful class of complicated watches, calendars, repeaters, chronographs, etc., etc., combined in one watch, and elaborately cased and artistically finished. The great element of merit in this exhibit is in the combination of the great number of unusual functions for a watch, and by skill in workmanship and mechanical science securing a correct performance.

The enormous cost of these watches is an effectual embargo on their use to any except the very few, and their utility is, therefore, very limited. In their class they are, however, of the first order of merit, and adjudged a first-class award.

G. TRIBANDEAU

exhibits a considerable collection of watches in a great variety of cases, of a class of workmanship, finish, and performance calling for the fourth order of merit, and are adjudged a fourth-class award.

A. H. RODANET

exhibits two marine chronometers only, one of which was broken and the other out of order; commended.

INTERNATIONAL WATCH COMPANY

exhibit a collection of watches of the third order of merit, and adjudged a third-class award.

In concluding this report, the judges very much regret the limitation in time which has prevented them securing position tests of this very interesting exhibit in horology, as much on account of the exhibitors as on their own account. Such advances have in the last few years been made in this science that, in the interest of the public as well as of the manufacturers, a sufficiency of time is desirable to make tests in five or six positions, and fourteen days should be allowed to each position. Tests for heat and cold, and an opportunity to carefully note barometric and thermometric influences upon the various systems of adjustment, would be very valuable and interesting.

Respectfully, etc.,

GREGORY P. HARTE, *Chairman*, United States.
H. C. RUSSELL, B.A., F.R.A.S., Great Britain.
J. MCGARVIE SMITH, New South Wales.
P. E. BOUND, Switzerland.
E. BECKMANN, Germany.

Corn Magnets.

Every kind of salve or lotion that is supposed to remove or relieve corns meets with a large sale. Corn files and pencils are getting stale, and an enterprising inhabitant of Dresden has lately brought out what he calls a "corn magnet." It is evident that it is as unlike a magnet as possible, for an examination shows that it is made of sulphur colored with graphite. The directions are to set fire to one end, and let a drop of the melted sulphur fall upon the corn. A convenient and agreeable operation, especially if the corn is on the bottom of the foot. It is needless to say that the corn usually survives the slight burn and lives to torment the owner again. All burns, whether by caustic or otherwise, should be avoided.

Experiments on the Resistance of Materials.

Prof. J. Burkitt Webb, C.E., now in Europe, writes as follows:

On the invitation of Prof. Spangenberg we visited the "Versuchsstation," at the Gewerbe-Akademie, where the important experiments upon materials for engineering purposes are being made. These tests are of two kinds—trials of strength and trials of endurance. The first are made by means of very heavy and accurate machinery, mostly new within the last two or three years; the latter are the celebrated "Dauer-Versuche," a description of which we will reserve for another letter.

The main machine, of which there are three or four duplicates at work at various points in Germany, is housed in a special building in the interior court of the academy. It consists of heavy iron "ways," some fifty feet long, accurately planed and secured to a stone foundation, with a hydraulic pump and scales at one end, and a number of massive attachments for subjecting the piece of iron or other material to various kinds of strains. There are also other instruments which belong to the machine as delicate as it is heavy, and which are used for adjusting the parts of the apparatus, reading the results of a test, or making calculations. This machine differs from others in the way of measuring the force used. It has been the custom to take the pressure on the liquid in the hydraulic cylinder, as shown by a manometer, as the basis of calculation. This introduces an inaccuracy, as part of this is due to the friction on the piston packing, and the true pressure is less than that shown by this irregular quantity. To avoid this difficulty a massive lever is introduced between the hydraulic press and the point where its pressure is applied. One arm of this lever is one-eighth inch long, and the other five hundred times as long, so that to measure a pressure of one hundred tons, four hundred pounds must be placed on the scale pan which hangs from the end of the long end of the lever. The fulcrum rests against the piston, and the short end of the lever is connected by heavy links with the apparatus by means of which the strain is applied. Technically speaking the fulcra of scales are "knife edges," but to convey a pressure of one hundred tons and remain free to move, these edges must be very obtuse, perhaps 160° to 170°; they must be as long as possible, some fifteen inches, of the best hardened steel, accurately ground, and must rest against a hardened plate of steel. Made with the greatest care the sharp edge under such a pressure will sometimes make a dent in the plate and the scales are clogged. As it is very difficult to measure the one-eighth inch with accuracy, another lever is provided with a ratio of one to ten, and with a short arm long enough to be made of a certain length with but a small percentage of error. To test the main lever this occupies essentially the same place as a sample of iron to be stretched; it is loaded with, say, two hundred pounds, which it multiplies to a ton; this pressure is then weighed by placing four pounds upon the main scale pan, and the fulcrum of the main lever is adjusted until the two weights balance.

The attachments consist of: I. Jaws for holding round, square, and flat bars to be submitted to tension. II. Arrangements for holding beams and columns in various ways at their ends, and compressing them until they are crushed or "buckle." III. Two massive graduated iron beams, which are placed crosswise on the "ways," and used for twisting shafts, railroad axles, etc. IV. A face plate, about four feet square, for holding plates of boiler iron nearly as large by the perimeter, and crushing in the middle by forcing various shaped pieces against it. V. Apparatus for bending a beam by crushing an angular piece into it; and in the same connection, VI. Shears for cutting off bars of metal and measuring the force required.

In connection with this main machine were some, quite old, which had been used in the infancy of the subject by a former professor, and a new special machine for the same purpose as attachment V., and which seemed to "kink" a piece of railroad iron as if it were only lead. In this the pressure was obtained by screws.

Among the instruments used for the adjustment of the parts of the main machine we saw the finest cathetometer we had ever seen. This instrument, by Breithaupt, in Cassel, has two telescopes, with micrometer screws with more than one hundred and twenty-five threads per inch, and scales graduated on glass with more than six hundred and twenty-five divisions to the inch. Another instrument for measuring the deflection, in two directions at once, of a column under pressure, has micrometer screws with more than two hundred and fifty threads per inch. We saw also a planimeter, which not only calculated mechanically the area of a figure, but gave also its center of gravity, moment of inertia, etc. We saw also a French calculating machine; the other apparatus is, we believe, all German. If one is, however, critical, it will be found in many lines of business that all the fine goods here are imported, though naturally the Germans are slow to acknowledge it.

We witnessed the experiments on a sample of round iron over an inch in diameter, and on a piece of iron plate three inches wide by half an inch thick. It is perhaps needless to say that they seemed to stretch like putty and to break like thread. The pressure is put on a few hundred pounds at a time, and the elongation is read by two telescopes and a scale, which multiply the distance five hundred times. At the same time the first "elastic limit" is watched for. Before this is arrived at the piece will return to its original length when the tension is removed; after this the stretching is in part permanent. One of the facts brought out is that there are *several* elastic limits, in copper seven or eight. The appearance of the surface after the elastic limit is passed and the iron stretches is peculiar. A wavy appearance is seen, and longitudinal ridges begin to form, due to the changes going on in the crystals, by which they adapt themselves to the increased length. After a further general adaptation of structure becomes impossible, these appearances culminate in the weakest part. The apparatus for measuring the increase in length has long since been removed, and the places where it was attached have been filed smooth to avoid introducing the weak point artificially. The diameter of this part now reduces rapidly, and the surface becomes rough and the iron hot—you can see it stretch. When it has reduced twenty-five or more per cent it gives way suddenly with a sharp crack. The percentage of reduction before breaking is now recorded with the observations on the elasticity and the breaking strain, and the experiment is at an end. It suggested itself to see if the work done in pulling the iron apart was fully accounted for by the heat generated. We could easily calculate the work up to the point of maximum tension, but after this the force required was not measured; however, a rough calculation showed that the iron was as hot as required, or at least that the data would require to be quite complete if any residual was to be found.

Berlin, May 13, 1880.

ENGINEERING INVENTIONS.

An improved wheel guard, which will push any obstacles on the track aside, and which can be adjusted to a greater or less height above the rails, has been patented by Mr. Solomon Brisac, of New York city. It consists in a wheel guard formed of a metallic box with a beveled front side, which box is adjustably fastened to the front end of a recessed plate resting on and partially surrounding the grease box. The box is braced by means of a rod attached to its forward end and passing into a socket fastened to the bottom of the car.

An improved water motor, constructed on the general principle of a rotary engine, in which two compartments are arranged side by side, with a partition intervening, and in which the sliding pistons in the piston wheels in the two compartments are arranged at right angles to each other, has been patented by Mr. William E. Seelye, of Anoka, Minn.

Mr. Stephen Barnes, of New Haven, Conn., has invented a vibrating propeller, adapted to small boats and vessels to be operated by either hand or steam power. The floats are arranged so that they will offer no resistance on the return stroke.

An improved device for removing snow from railway tracks, and especially from between the rails, has been patented by Mr. David M. Horton, of Fishkill Village, N. Y. It consists of a revolving brush, a mould board in juxtaposition thereto, and a fan blower, in combination with suitable driving gear for propelling the brush and fan.

An improvement in steam traps, patented by Mr. Hugh O. Ames, of New Orleans, La., consists in combining with a vibratory arm carrying a water receiver, a side apertured hollow trunnion, a discharge pipe, a jacketed standard, and an outlet pipe.

An improved cotton press has been patented by Mr. Alfred A. Janney, of Montgomery, Ala. This invention relates to an improvement in the class of cotton and hay presses in which the follower is worked by a screw that passes through a nut, to which the required rotary motion is imparted by means of lateral sweeps or levers. It consists in the means for supporting and securing the levers and forming a vertical guide for the screw, so that the levers are prevented from rocking or swaying as power is applied in the operation of packing.

Improved Steam Canal Boat.

The late experiments in canal steamboats bid fair to be a complete success. The Baxter steamers were not sufficiently remunerative to continue the building of that kind of boat. They do not carry a sufficient load, owing to their build, and that is made necessary by the form and arrangement of the machinery and propelling power, the propeller being that form used by the tug in Buffalo. The new style, which bids to pay handsomely, is as full a bow and stern as the ordinary first-class canal boat. The propelling power is radically different from the tug propeller. The wheel is eight feet in diameter and placed close to the stern; the boiler is upright, with a single engine, very compact machinery, taking up no more room than the stable in many boats, and enabling the boat to carry 7,500 bushels of corn and coal for the trip. With this cargo they run from Buffalo to New York in seven days on five and a half gross tons of coal, saving river and harbor towing. One returned from New York to Buffalo in one hour less than seven days, bringing one hundred and thirty tons of freight. The outlook now promises to supersede mule and horse towing. The Belgian system of cable towing will take that large number of boats now relying on the mule, and deliver them promptly as consigned and in much less time and cost than can be done by the mule. Both systems are necessary for rapid movement on the canal, and to cheapen the transfer from the West to the seaboard. Steam is sure to supersede animal power on the canal, as everywhere else. The canal steamboats are at last so far perfected as to insure a handsome profit in running them, and a large number will soon be at work on the canal. Two are to be constructed in Lockport as speedily as possible by one of our most enterprising boat builders, and the machinery is contracted for, thus opening up a new industry for our numerous and worthy mechanics.—*Lockport (N. Y.) Journal.*

Astronomical Notes.

OBSERVATORY OF VASSAR COLLEGE.

The computations in the following notes are by students of Vassar College. Although merely approximate, they are sufficiently accurate to enable the ordinary observer to find the planets. M. M.

POSITIONS OF PLANETS FOR JULY, 1880.

Mercury.

On July 1 Mercury sets a few minutes after 9 in the evening.

Mercury can be readily found, early in July, a few degrees south of the point of sunset; the planet moves rapidly southward, but can be followed, and may be seen as late as the 20th. On July 18 Mercury has nearly the declination of Regulus.

Venus.

Venus keeps nearly the path of the sun, setting after the sun late in July, but so nearly with it that the planet is not likely to be seen.

Mars.

Mars has moved from its position nearly in line with Castor and Pollux toward Leo. It sets on July 1 at 9h. 44m. P.M. On the 31st Mars sets at 8h. 32m.

On the 31st, at meridian passage, Mars and Uranus are nearly together. Uranus is east of Mars and half a degree south.

Jupiter.

Jupiter is coming into the evening hours.

On July 1 Jupiter rises a few minutes after midnight. On July 31 Jupiter rises a few minutes after 10 P.M. It will be known at once by its brilliancy.

Besides the ordinary belts of Jupiter the planet still shows at this time (June 10) the large ruddy spot spoken of by many persons some weeks since. This spot is elliptical in shape; its longest diameter is about one fifth that of Jupiter. A small glass will show it, and the ordinary observer can, by watching its appearance and disappearance and reappearance, determine the time of rotation of Jupiter on its axis, or the length of the planet's day.

The best evenings for looking at Jupiter are those of July 23, when the satellite nearest to Jupiter goes across its face, preceded by its shadow; July 28, when the first and second satellites will make similar transits; and July 29, when Jupiter will rise without the presence of its third satellite, which will be in eclipse, and will come out of the shadow after midnight.

Saturn.

Saturn follows close upon Jupiter, but keeps further north in declination by about 2½°.

On July 1 Saturn rises 36m. after midnight. On the 31st Saturn rises at 10h. 38m. P.M.

The waning moon will pass north of Jupiter and Saturn on the 27th to 28th.

Any one who has a glass sufficient to show the ring of Saturn and the largest satellite, Titan, will find this planet intensely interesting, and the movements of the satellite will show the time of its revolution in its orbit around Saturn.

Uranus.

Uranus rises after the sun, and sets too nearly with the sun to be seen.

Neptune.

Neptune may be seen, with a good telescope, in the early morning hour. Neptune is 2¼° west of Alpha Ceti, and 11° north. It approaches Alpha Ceti during the month, and if it can be found, may be known to be a planet by that movement.

Fires in New York.

The report of the Board of Fire Commissioners, just printed, shows that during the year 1879 there were in this city 1,551 fires, of which 1,029 were discovered by persons not connected with the Fire or Police Department. In 1,456 cases the fires were confined to the buildings in which they originated. Twenty-five buildings were totally destroyed, and 69 were greatly damaged. Of all the fires, 1,061 were extinguished by buckets of water and fire extinguishers. The total estimated loss by fire during the year was $900,280 on buildings and $4,771,300 on stock, making a total of $5,671,580. The estimated insurances on the buildings were $7,276,446, and on stock, $14,525,264, making a total of $21,801,710. The estimated uninsured loss was $180,060. In three cases the loss was between $100,000 and $115,000; in one case $168,908; in one case $352,185; in one case $333,900; and in one case $1,978,991. In 1,066 cases the loss was less than $100.

Nearly a quarter of all the fires were caused by carelessness, and 100 are attributed to children playing with matches and fire. Forty fires were caused by the spontaneous combustion of oily rags and other materials, and 93 by exploding kerosene lamps. Four members of the department and 12 citizens died of injuries received at fires during the year, and 139 firemen and 54 citizens were more or less injured.

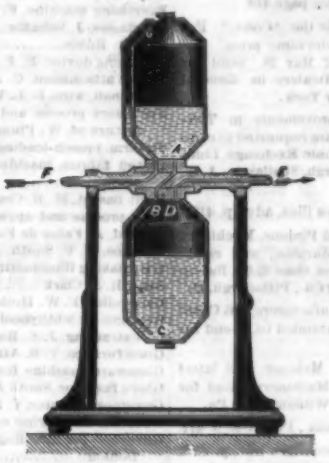
There are 729 uniformed members of the department. The pay roll of the whole department for 1879 was $1,030,-822.14, and the appropriation for all expenses was $1,254,-970. The appropriation for the present year is $1,307,670. The department now possesses 233 horses, 1 marine steam fire engine, 58 steam fire engines, of which 5 are self propelling, 10 chemical engines, 24 hook and ladder trucks, 108 chemical fire extinguishers, and 4 aerial ladders, together with other fire apparatus.

The annual inspection of the department showed that the quickest average time in hitching a team was 3·17 seconds, and in hitching a single horse, 5·66 seconds. The general average in hitching all apparatus was, in 1879, 9·54 seconds; in 1878, 10·26 seconds; and in 1877, 13·03 seconds.

During the year, $30,300 was collected for licenses for the sale of kerosene oil, each license costing $10. The Fire Department Relief Fund now amounts to $422,569.07, and the insurance fund to $12,780.

ASPIRATOR AND COMPRESSOR.

Professor Marangoni, of Pavia, has invented an aspirator for measuring gases which is much simpler than many now in use in laboratories, which latter have the defect that the air or gas ascends through the descending liquid and makes thus the measuring of the former uncertain. The improved apparatus is shown in our illustration. It consists of two vessels attached to a fixed horizontal shaft, F E, which is placed upon two upright supports. This shaft has several ways or passages made in it which performs the functions of the taps. The water of the upper receptacle passes into the lower one by the passage, A, and thence through the tube, B C, issuing at its lowest extremity at C. The air contained in the lower vessel is thus emitted by the channel



D E, cut into the shaft, while the air or gas is aspirated in the same ratio by the passage and tube, F G. The apparatus acts thus at the same time as aspirator and compressor. It is simple, and will be a useful addition to the laboratory.

New Photoglyptic Process.*

WALTER B. WOODBURY.

It is now thirteen years since I had the honor of introducing in France my new photoglyptic process, which, up to the present time, has remained in the hands of very few, owing to the great expense hitherto necessary to start the working of it. For some time I have been engaged in making experiments with a view to discover a system which should be at the same time simple and inexpensive; and the process which I have this evening the honor to bring before your notice is the result of my researches.

The summary of the new system is as follows:

To obtain from negatives reliefs on glass similar to transparencies by the carbon process, but modified in the quantity of materials used.

To attach, and keep in absolute contact with the relief so obtained, a sheet of tin foil.

To solidify this sheet of tin foil by coating it with copper; then backing it up with another sheet of plate glass covered with a composition; and then to detach the whole from the first relief—the result being a mould ready to place in the press and print one thousand or more proofs.

I commence by showing you the relief made from the negative, and explaining how this is obtained.

I take a sheet of plate glass of a convenient size, and place it in hot water, together with a sheet of paper a little smaller; then, having driven out the excess of water by means of a squeegee, I place it on a leveling stand. Having prepared a solution composed of gelatine 200 parts, water 1,000 parts, glycerine 20 parts, white sugar 30 parts, with a little Indian ink, and filtered the same, I pour a sufficient quantity on the paper and spread it up to the corners with the finger. These plates are then dried in a dry place and can be kept until wanted.

To sensitize the plates I employ a bath of bichromate of potash of six per cent, and again dry them. Without doubt this method is rather long; but one should consider that each proof made is capable of giving five or ten thousand prints if necessary, as the same relief will make many printing moulds. I tried, with the aid of the Autotype Company, of London, to get a suitable tissue; but as this requires a uniform thickness of half a millimeter the ordinary system did not succeed. When the sensitized plate is dry the edges are cut with a knife, the glasses serving over and over again. I show you a piece of this prepared paper.

As in the carbon process, it is necessary to place a border of black paper at the back of the negative, and to cut the sensitized tissue a little larger than the opening.

After the exposure the gelatine is fixed on a collodionized glass by placing them both in water and squeegeeing the surface; but in dry weather it is as well to use albumen in place of collodion, as used by M. Farrier for his transparencies in carbon. The glass holding the gelatine is now placed in a hot water bath heated to 42° Centigrade, and left till the paper comes away from the gelatine, when it is placed in this apparatus by the frame holding the grooves.

By means of this small gas regulator the temperature is kept always the same, namely, 50° Centigrade. The water should be now and then agitated by lifting up and down the frame holding the glasses.

After a space of three or four hours the reliefs will be sufficiently washed, and can be taken out and placed in alcohol to dry quickly and sharp at the same time. In this stage of the process all spots or scratches that may have been on the negative can be removed (being in relief on the gelatine) by means of a piece of glass. The relief is now ready to be covered with the tin. You will observe that up to the present the operations have been almost the same as those necessary to produce a transparency in carbon.

As it is of the first necessity that the tin should be kept in absolute contact with the gelatine relief, I prepare the latter by rubbing it over with a piece of flannel charged with a greasy matter (pomatum answers as well as anything). I then make a border of India-rubber in benzine round the glass. The effect of this is to prevent any air from returning between the tin and the relief when once it has been driven out.

Taking care that the back of the glass is perfectly clean, it is now placed on the steel or glass bed of a rolling-press. A sheet of tin foil (without holes) that has been smoothed on a sheet of glass by a soft brush is now laid on it, and then three or four thicknesses of blotting paper. The whole is then passed under the cylinder several times, each time increasing the pressure. The surface of the tin is now ready to place in the electrotyping cell, but must first be cleaned with a solution of caustic potash to remove any grease, and bordered with shellac varnish to prevent the copper from depositing where not required.

Electric contact is made by means of the small apparatus, on removing a small proportion of the lac varnish. After two or three hours sufficient copper will have been deposited, and after drying can be then attached to another glass, on which it will remain.

This glass is covered while hot with a composition of shellac, resin, and Venice turpentine, and can be prepared in advance, using an iron plate heated direct by the gas flame. The same iron plate is employed to again soften the composition and attach it to the copper; but this time heated only by boiling water, this temperature being sufficient to soften it until it enters into all the hollows of the copper. On placing a weight on the two glasses the excess of the composition is forced out at the edges. When cold the glass plate on which the copper and tin are now attached can be separated from the relief, which can then be used over and over again to produce fresh matrices.

The matrix or intaglio is now ready to place in the printing press, and the remaining operations of printing are exactly the same as those used in the old process of photoglyptic printing.

In placing the mould in the press it is advisable to place one or two thicknesses of stout blotting paper, previously wetted, under the mould to give to it a slight amount of elasticity and, at the same time, to keep it in place.

As in all other mechanical processes a reversed or pellicle negative is required; but it is very simple to print upon a specially prepared transfer paper, and, instead of mounting the print with the face uppermost, to attach it under water to the mount, and when dry to detach the paper on which the print has been made. By this means there remains only one thickness of paper instead of two, thus doing away with an objection which has often been found in mounted photographs for book illustration.

* A communication to the Photographic Society of France.

NEW INVENTIONS.

An improved combined cutting and clinching tool has been patented by Mr. Peter D. Graham, of Black Hawk, Col. The object of this invention is to provide a new, useful, and convenient tool for cutting and clinching horse-shoe nails.

Mr. John J. Berger, of Brooklyn, N. Y., has patented an improved hand perforating or check stamp of the class which are used to cut or perforate the paper with figures and letters as a safeguard against alterations of the check; and the object of this improvement is to perforate the check with needle points, and at the same time ink the perforations, whereby the numbers may be clearly marked without cutting large openings in the paper.

An improved apparatus for the manufacture of nitric acid has been patented by Mr. Paul Marcelin, of Black Rock, Conn. The object of this invention is to furnish apparatus for manufacturing nitric acid so constructed that the stronger acid may be separated from the weaker acid as the acid passes from the retort to the receiving bottles, to obtain a strong acid suitable for use in manufacturing nitro-glycerine.

Mr. Max Rubin, of New York city, has patented an improved shawl strap, so constructed that either strap may be wound up alone, or both may be wound up together, or one may be wound up tighter than the other, by adjusting the handle.

Mr. Ambrose Madden, of Asbury Park, N. J., has patented an attachment for use with halters for preventing horses from cribbing and to cure them of that pernicious habit; and the invention consists in a combination of rigid arms and straps hung upon the halter and carrying a spiked plate, which is retained beneath the animal's under lip in such manner that the motions of the horse in the act of cribbing cause the spikes to prick.

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For Sale,—A Baltimore City Fire Department Steam Fire Engine, in complete working order. Address P.O. Box 478, Baltimore, Md.

Metallic Piston Rod Packing Company, 775 Broad St., Newark, N. J. Agents wanted; terms liberal.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Asbestos Board on Chimneys prevents their heat from affecting the temperature of rooms through which they pass. Asbestos Pat. Fiber Co., Ilm., 194 Broadway, N. Y.

Sweetland & Co., 126 Union St., New Haven, Conn., manufacture the Sweetland Combination Chuck.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 32 Dey St., N.Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Corrugated Traction Tire for Portable Engines, etc. Sole manufacturers, H. Lloyd, Son & Co., Pittsburg, Pa.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros. 421 Jefferson St., Philadelphia, Pa.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

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For Separators, Farm & Vertical Engines, see adv. p. 381.

Walrus Leather, Emery, and Polishing Goods. Greene, Tweed & Co., 118 Chambers St., New York.

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Bradley's cushioned helve hammers. See illus. ad. p. 397.

Instruction in Steam and Mechanical Engineering. A thorough practical education, and a desirable situation as soon as competent, can be obtained at the National Institute of Steam Engineering, Bridgeport, Conn. For particulars, send for pamphlet.

Hydraulic Jacks, Presses and Pumps. Polishing and Buffing Machines. Patent Punches, Shears, etc. E. Lyon & Co., 470 Grand St., New York.

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For Mill Mach'y & Mill Furnishing, see illus. adv. p. 381.

Air Compressors, Blowing Engines, Steam Pumping Machinery Hydraulic Presses. Philadelphia Hydraulic Works, Philadelphia, Pa.

For Patent Shapers and Planers, see ills. adv. p. 380.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 398.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Large knife work a specialty. Also manufacturers of Soloman's Parallel Vise. Taylor, Stiles & Co., Riegelsville, N. J.

For Alcott's Improved Turbine, see adv. p. 397.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 381.

Robbins Mac. Co.'s Wood Working Mach'y ad. p. 380

Improved Solid Emery Wheels and Machinery, Automatic Knife Grinders, Portable Chuck Jaws. *Important*, that users should have prices of these first class goods. American Twist Drill Co., Meredithville, N. H.

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Penfield (Pulley) Block Works. See illus. adv. p. 413.

4 to 40 H. P. Steam Engines. See adv. p. 413.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

June 1, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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Adding machine, C. P. Sullivan 228,416
Advertising checker board, H. P. Eysenbach 228,330
Annunciator, pneumatic, D. & T. Morris 228,367
Axle lubricator, car, C. D. Flynt 228,337
Axle lubricator, vehicle, L. Adams 228,343
Bale tie, W. S. E. Sevey 228,225
Baling press, H. O. King 228,361
Bedstead, invalid, E. Conover 228,319
Bedstead, sofa, C. S. E. Spoerl *et al* 228,409
Belting and process of manufacture, cotton, M. Gandy 228,186
Belts, lacing, O. C. Pomeroy 228,390
Berth for vessels, self-leveling, D. Huston (r) 9,224
Berth for vessels, self leveling, C. C. Sanderson 228,278
Berth, self-leveling ship's, C. C. Sanderson 228,279
Binders, knot tyer for self, W. Stephens 228,228
Blacking and polishing boots and shoes, machine for, P. P. Audoye 228,207
Blower, fan, H. Allen 228,293
Bolting tree, J. M. Springer 228,409
Boot and gaiter, rubber, G. H. Sanford 228,308
Bottle, etc., lock, A. T. Boone 228,170
Bottle stopper, E. Hollender 228,355
Bow strings, clutch for, C. M. Beard 228,302
Bracelet, C. E. Hayward 228,348
Bracelet, A. Vertor 228,415
Bran cleaner, L. Gathmann 228,340
Brick, pottery, etc., kiln for burning, E. Escherich 228,331
Buckboard, E. Hitt 228,352
Buckle, tug, D. O. Fosgate 228,336
Bumper, W. V. Perry 228,385
Bung, J. H. Stamp 228,337
Button fastener, D. Bainbridge 228,296
Button, sleeve and cuff, H. McDougall 228,373
Buttons, machine for making, W. W. Wade 228,233
Can, D. Bennett 228,167
Can fastening, J. Hall 228,343
Car coupling, Neff & Thalman 228,378
Car coupling, J. F. Stanley 228,411
Car coupling, Mourad & Edwards 228,212
Car coupling tool, G. Searl 228,400
Car door bolt, A. W. Zimmerman 228,241
Car wheel, J. A. Woodbury 228,420
Car wheel chill, W. Wilmington 228,428
Cars, bell cord guide for railway, S. L. Finley 228,258
Cars upon railways, running, J. R. Cox 228,176
Carbureting gas and air, W. M. Jackson 228,357
Card teeth, apparatus for tempering wire for, W. F. Bateman 228,301
Carpet fastener, W. Bray 228,306
Carpet lining, G. J. Bicknell 228,168
Carpet sweeper, R. W. Johnson 228,358
Carriage top, E. S. Scripture (r) 9,220
Carriage top rest, G. Miles 228,211
Cartridge shells, machine for drawing, A. C. Hobbs 228,197
Centering machine, J. E. Dimsey 228,249
Chair seats and backs, making, F. D. Newton 228,377
Chandelier, extension, G. Bohner 228,244
Cheese press, M. B. Fraser (r) 9,223
Cheese press, G. F. White 228,291
Cheese vat, J. B. Marquis 228,366
Chuck, J. H. Westcott 228,426
Churn, E. Rhoades (r) 9,225
Clock, alarm, F. Krober 228,202
Clock, calendar, C. S. Lewis 228,261
Clock case, G. Havell 228,198
Cloth pressing machine, P. Miller 228,375
Clutch, W. J. Ray 228,276
Cockle separator, D. Brubaker 228,310
Collar, horse, T. Hepburn 228,351
Commode, A. Climie 228,313
Copying process, dry, Kwayser & Husak 228,362
Cork tapering machine, F. L. Blair 228,169
Corn husking machine, F. L. Collis 228,174
Corn husking machine roller, E. A. Bourquin 228,305
Corn popper, D. Lumbert 228,205
Cornice, window, H. F. Gray 228,189
Cranks, device for overcoming the dead points of, C. L. Fleischmann 228,185
Crochet needles, manufacture of, J. A. Smith 228,404
Crucible furnaces, hydrocarbon burner for, I. M. Beamans 228,281
Cutlery, pocket, J. W. Ayers 228,163
Danger signal, M. A. Vosburgh 228,232
Diagram for theaters, etc., H. T. Lemon 228,204
Domestic boiler, C. Friedeborn 228,339
Drawing, apparatus for assisting in, W. B. O. Peabody 228,273
Drying apparatus, W. J. Johnson 228,259
Electrotype mould, E. B. Sheldon 228,224
Exercising machine, F. Saunders 228,277
Eyeglasses, J. Schaffer 228,396
Fan, M. Rubin 228,394
Fastening device, E. F. Miller 228,373
Faucet attachment, C. A. Raggio 228,219
Fence nail, wire, E. L. Warren 228,236
Fertilizers, process and apparatus for the manufacture of, W. Plumer 228,387
Firearm, breech-loading, W. H. Baker 228,165
Flated fabrics, machine for creasing, E. Brosemann 228,309
Fruit basket, H. B. Crandall 228,248
Fuel, process and apparatus for burning pulverized, A. Faber de Faur 228,334
Furnace, B. F. Smith 228,405
Gas, making illuminating, T. J. F. Regan 228,392
Gate, E. J. Clark 228,314
Gate roller, F. W. Holbrook 228,354
Gelatine or ichthyocolla from salted fish skins, extracting, J. S. Rogers (r) 9,226
Glass furnace, T. B. Atterbury 228,206
Glassware, machine for grinding, A. M. Bacon 228,164
Glove fastener, Smith & Hassall 228,403
Governor, elevator, I. H. Small 228,284
Governor for marine engines, W. U. Fairbairn 228,253
Governor for middlings purifiers, etc., feed, W. Donlon 228,180
Grain conveyer, pneumatic, F. A. Luckenbach 228,206
Grain meter, J. B. Stoner 228,229
Grain separator, magnetic, C. E. Fritz (r) 9,229
Grate, fire, E. Moneuse 228,376
Grinding and polishing wheel, G. Hart 228,257
Hammer lifter, drop, C. G. Cross 228,234
Harness, breast J. W. Cooper 228,178
Harrow, S. A. Bollinger 228,303
Harrow, C. W. Page 228,382
Harvester, Jones & Emerson 228,359
Header, guiding, W. H. Keen 228,260
Heating and ventilating apparatus, J. W. Geddes 228,188
Hinge, spring, L. Bommer 228,304
Hitching strap, J. C. Covert 228,322
Hoes and other tools, eye for, J. R. Thomas 228,419
Hog holder and nose ring carrier, W. A. Stark 228,286
Horse hoof pad, A. J. Lockie 228,263
Horse power equalizer, W. T. G. Cobb 228,173
Horse power sweep, J. Branning 228,307
Horseshoe nail machine, J. Roy 228,220
Hose coupling, S. Adlam, Jr 228,161
Hose coupling, M. B. Hill 228,196
Hot air furnace, B. W. Felton 228,336
Hydraulic joint, E. D. Meier 228,200
Indigo blue, making artificial, A. Baeyer 228,800
Lamp, car, G. Seagrave 228,402
Lamp globe, G. Chappel 228,247
Lamp, street, J. G. Miner 228,265
Last, W. J. Crowley 228,179
Latch, G. L. Crandal 228,323
Life protector for railway rails, E. J. Hoffman 228,353
Lifting jack, J. State 228,285
Lithographic press, J. A. Parks 228,271
Lock, C. F. Otto 228,379
Locomotive, J. B. Smith 228,406
Locomotive cone, F. A. Perry 228,386
Locomotive engine, J. W. Clardy 228,172
Locomotive lubricator, W. P. Phillips 228,215
Loom for weaving gauze fabrics, A. McLean 228,372
Loom shedding mechanism, H. Halcroft 228,191
Loom temple, R. Hamilton 228,346
Loom temple, J. & L. Hardaker 228,256
Lubricator, W. P. Phillips 228,216, 228,217
Mash machine, W. Craig 228,177
Mash rake, whisky, D. L. Graves 228,190
Mash stirrer, G. Schock 228,222
Measuring machine, cloth, B. K. Parker 228,381
Middlings purifier, J. B. Martin 228,367
Milk cooler, T. Stahler 228,412
Milk pail holder, A. C. Dodge 228,327
Mining and excavating apparatus, E. M. Hugentobler 228,256
Mortising machine, R. H. N. Clarkson (r) 9,221
Nickel, solution for electro-deposition of, J. Powell 228,389
Oil and lard oil, treatment of petroleum lubricating, H. V. P. Draper 228,181
Ore separator, magnetic, T. A. Edison 228,329
Packing for piston rods, etc., metallic, L. Katzenstein 228,200
Packing for steam engines, spring, J. W. Smith 228,225
Packing, piston, W. M. Thompson, Jr 228,420
Packing, piston rod, R. B. H. Gould 228,341
Padlock, McDonald & McAllister (r) 9,227
Pantaloons, F. H. Carney 228,248
Paper bag machine, C. A. Chandler 228,313
Paper floor covering, compound, H. Hayward 228,194
Paper for bank notes, checks, etc., J. Sangster 228,221
Parchment or toughening paper, making artificial, L. H. G. Ehrhardt 228,330
Pens, pointing, E. Wiley 228,427
Permutation lock, J. B. Cook 228,316
Photo-negatives, producing, embellishing, and retouching, W. D. Osborne 228,380
Photographic background, accessory for forming, W. F. Ashe 228,205
Picture support, G. H. Brown 228,308
Pillow sham holder, M. A. Steers 228,414
Pipes, tubing etc., protector for the threaded ends of, H. E. Boyd 228,171
Planter, corn, R. H. C. Enyeart 228,333
Planter, corn, A. Hearst 228,255
Planter, corn, A. Hunstetler 228,206
Plow attachment, J. R. Harbaugh 228,193
Plumbers' traps, manufacture of, J. McCloskey 228,264
Preserving evaporated fruits and vegetables, H. G. Hulburd 228,199
Printer's chase, J. Kingsland, Jr 228,201
Printer's quoin, C. G. Squintani 228,410
Printer's type case, J. T. Edson 228,251
Pulley, J. B. Stockham 228,415
Pump, W. S. Laney 228,203
Pump, lift, P. T. Perkins 228,383
Pump, rotary, J. Hallner 228,344
Pump, steam jet, Randall & Tuttle 228,275
Railway heads, stop motion for, H. T. Spencer 228,407
Railway joints, angle splice for, J. D. Hawks 228,347
Railway signal apparatus, electric, O. Gassett 228,187
Range, D. H. Nation 228,268, 228,269, 228,270
Reclining chair, T. G. Maguire 228,263
Refrigerating and ice making apparatus, C. P. G. Linde 228,264
Rivets, making tubular, G. W. Tucker 228,423
Rock drills and earth augers, machine for operating, G. Taylor 228,418
Rubber bottles, etc., closing the openings in India, T. J. Mayall 228,207
Rubber, ornamenting hard, H., O., & M. Traun 228,290
Sash cord fastener and sash lock, combined, E. V. Heaford 228,349
Sash cord guide, E. H. N. Clarkson (r) 9,222
Sash fastener, S. P. Jackson 228,199
Sash fastening, J. Pusey 228,274
Sawing machine, circular, P. Pryibil 228,219
Sawing machine, drag, S. F. Steele 228,413
Sawing machine, drag, A. Wilkins 228,237
Screw bolt, L. Strauss 228,288
Screw threads, device for cutting, J. C. Williams 228,429
Sealing packages, E. A. McAlpin 228,368
Seaming machine, F. A. Walsh 228,234, 228,235
Sewing machine balance wheel pulley, E. Flather 228,184
Sheet metal joint, C. Wright 228,240
Shirt, G. C. Henning 228,195
Shoe, J. J. Snyder 228,226
Shoe nail, Z. Talbot 228,417
Shoe support, rubber, J. G. Foreman 228,336
Shoulder brace, C. A. Williamson 228,238
Sign, flexible, F. Tuchfarber (r) 9,223
Skiving machine, W. S. Fitzgerald 228,183
Skylight, W. D. Smith 228,282
Smoker's kit, T. V. Curtis 228,325
Soap and other materials, apparatus for mixing, W., Sr., W., Jr., & A. W. Cornwall 228,320
Soap, machine for mixing materials for making, W., Sr., W., Jr., & A. W. Cornwall 228,319
Soap, process and apparatus for remelting, W., Jr., & A. W. Cornwall 228,321
Soda water, apparatus for generating gas for, J. Collins 228,315
Spark arrester, locomotive, D. P. Wright 228,431
Spool box, C. Tolliner 228,289
Stamp, hand, T. Berridge 228,243
Stamp, postage, J. Macdonough 228,365
Steam engine, J. C. Miller 228,374
Steam engine recorder, G. H. Crosby 228,179
Steam generator, N. Eaton 228,250
Stove, A. C. Barstow 228,166
Stove grate, J. Moore, Jr 228,266
Stove, hay, Stocum & Merrill 228,287
Stove, magazine, C. Seaver 228,401
Surface gauge, F. J. Rabbeth 228,391
Swarm catcher, J. W. Bailey 228,299
Syringe attachment, S. Turner 228,422
Tackle or pulley block, T. R. Ferrall 228,335
Telephone, S. Russell 228,395
Telephone circuit switch, G. L. Anders 228,294
Telephones, dental attachment for, H. G. Fiske 228,254
Testing machine, T. Olsen 228,214
Textile and other materials, machine for cutting, A. Warth (r) 9,222
Textile fabrics, machine for cutting, A. Warth (r) 9,231
Ticket holder, C. Scherich 228,280
Ticket, railway, F. C. Sims 228,219
Tobacco caddy, R. Finzer 228,182
Tobacco hoisting apparatus, W. S. Guy 228,342
Tongs, pipe, S. Fawcett 228,332
Toy, creeping, P. Von Erichsen 228,231
Treadle mechanism, D. S. Van Wyck 228,434
Treadle power machine, G. W. Ziegler 228,432
Tree protector, J. W. Richards 228,396
Trimmings, fitter for milliners', J. Lambert 228,363
Tube machine, D. Appel 228,162
Valve, balanced, E. D. Meier 228,210
Vapor burner, W. H. Smith (r) 9,227
Vehicle spring, H. M. Keith 228,360
Vent for beer barrels, O. Zwietusch 228,239
Vessels, apparatus for unloading coal, etc., from, Cooney & Swanston 228,317
Vise and clamp, J. Brady 228,245
Wagon, road, C. W. Saladee 228,397
Wagon running gear, G. W. Burr 228,311
Wash boiler, O. Tilton 228,230
Washing and wringing machine, combined, C. H. Wood 228,229
Washing machine, J. B. Pettit 228,272
Water closets, flushing cistern for, S. G. McFarland 228,264
Water heater, K. McDonald 228,208
Water heater, fireplace, I. B. Potts 228,388
Whiffletree hook, E. Hanrahan 228,345
Windlass locking gear, Remington & Manton (r) 9,233
Windmill, A. H. Smith 228,283
Window screen, R. Perrin 228,384
Wire stretcher, H. Hemenway 228,350
Wood bit, L. Thuston 228,421

DESIGNS.

Carpets, T. J. Stearns ..... 11,800 to 11,803
Carriage door fender, M. Ward 11,805
Coffin lid lifters, J. W. Rogers 11,798
Fringe for knitted fabrics, G. Upton 11,804
Funeral ornaments, J. W. Rogers 11,799
Key bow, G. S. Barkentin 11,794
Medal batteries, Lewis & Brice 11,796
Pencil cases, L. W. Fairchild 11,795
Statuary, group of, J. Rogers 11,797

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Cigars, E. Aschermann & Co 7,924
Cigars, Giglio & Freschi 7,926
Dry goods, Eddystone Manufacturing Co 7,921, 7,923
Flour, B. B. Pegram, Jr 7,727, 7,728
Prints, Eddystone Manufacturing Company 7,922
Soap, C. Davis & Co 7,925
Teas, table, Sanders & George 7,912
Velocipedes, N. S. C. Perkins 7,920

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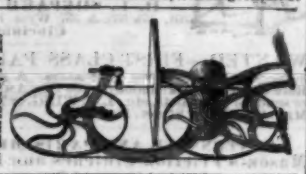

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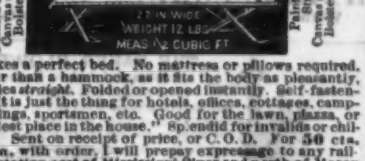
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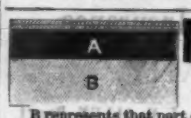

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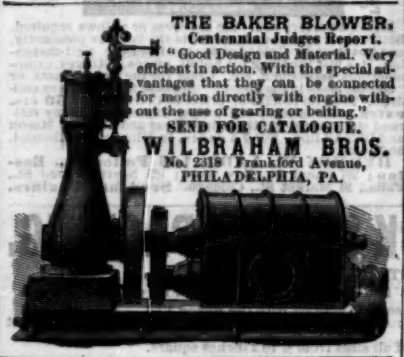

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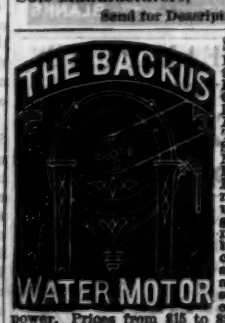

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